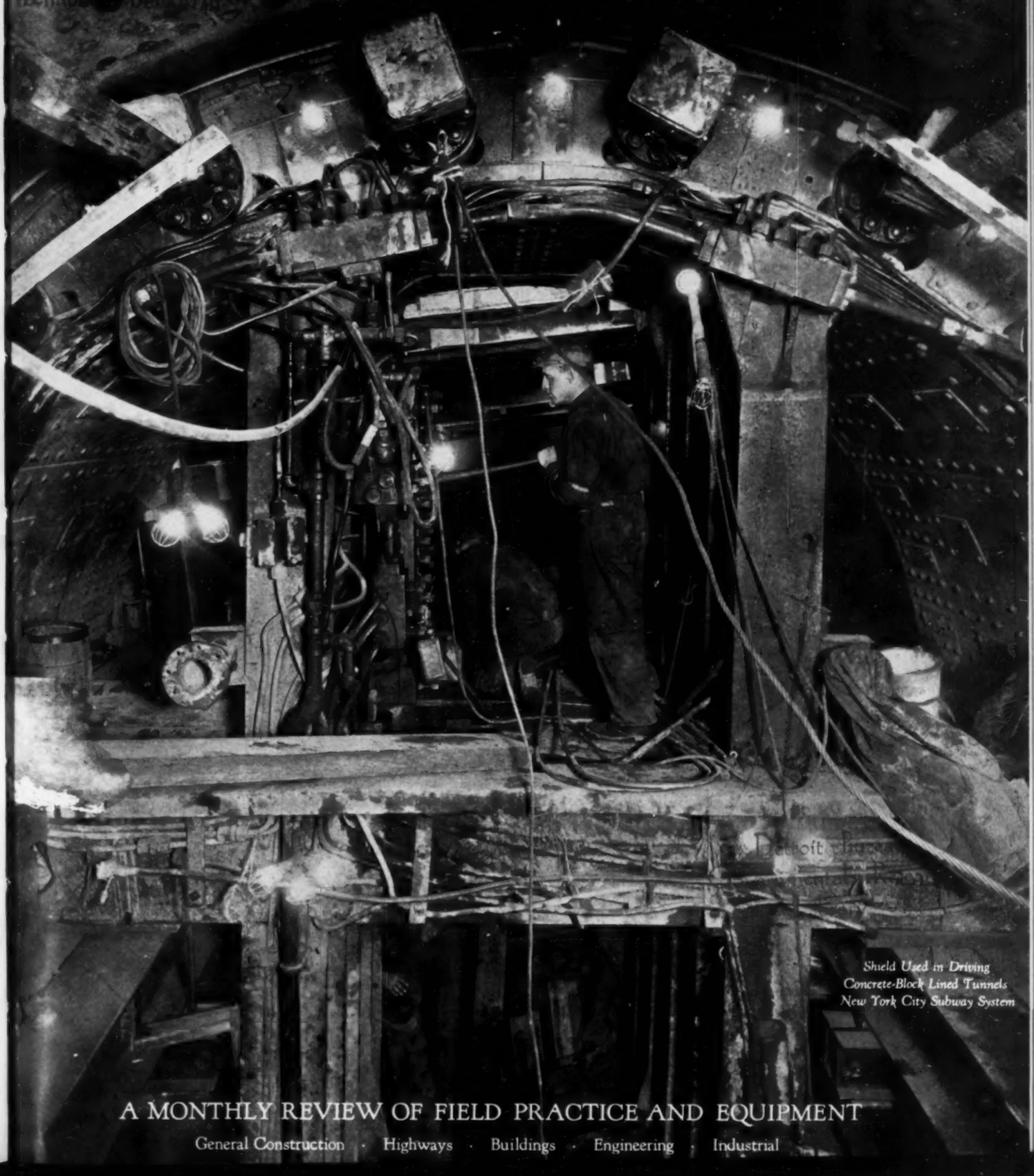
A McGRAW-HILL PUBLICATION

March 1931

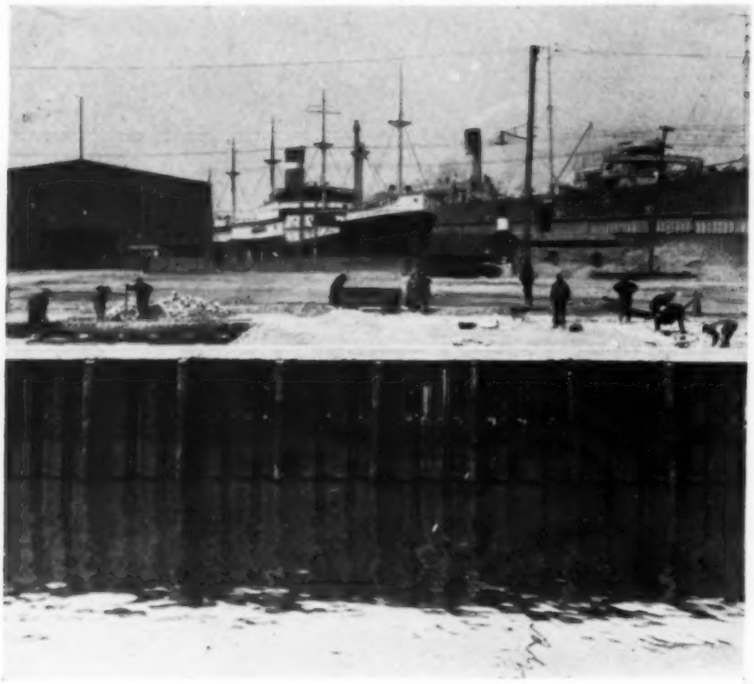
Construction Methods



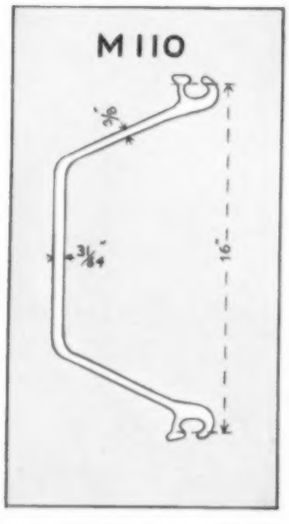
Shield Used in Driving Concrete-Block Lined Tunnels New York City Subway System

A MONTHLY REVIEW OF FIELD PRACTICE AND EQUIPMENT

General Construction · Highways · Buildings · Engineering · Industrial



CARNEGIE PILING FOR WHARVES AND SEA WALLS



THE Bulkhead at Brooklyn, a typical sea wall installation, was recently constructed by A. M. Hazell, Inc., for the Department of Docks, City of New York, Contract No. 1973. Carnegie Steel Sheet Piling, Section M 110, was used for the job with perfect satisfaction. This section, weighing 32 pounds per square foot and with a section modulus of 15.26 in.^{3} per lineal foot of wall, is particularly adapted to this type of construction, due to its great lateral stiffness.

Carnegie Steel Sheet Piling is rolled in an efficient range of weights and sizes, including both straight and arch web sections, to cover every possible condition requiring the use of piling. All sections are characterized by unusually strong interlocks, easy driving and exceptional watertightness. Arch web section M 114 has been recently added to the list. Weighing only 25 pounds per square foot, it has a section modulus of 10.95 in.^{3} per lineal foot of wall.

Insure satisfaction by using Carnegie Piling on your next job. The services of trained engineers are at your disposal.

CARNEGIE STEEL COMPANY, PITTSBURGH, PA.
Subsidiary of United States Steel Corporation 118

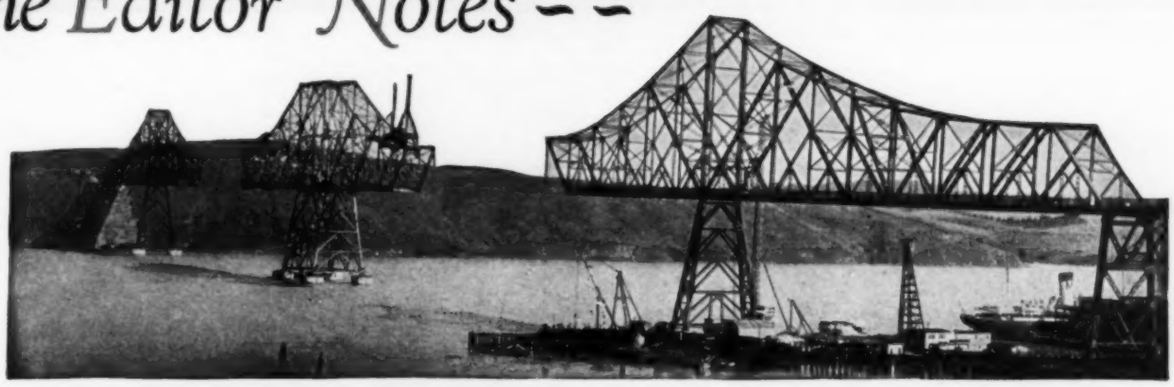
US STEEL

CARNEGIE
STEEL SHEET PILING

CONSTRUCTION METHODS, March, 1931. Vol. 13, No. 3. Published monthly. McGraw-Hill Publishing Company, Inc., Tenth Avenue at Thirty-sixth Street, New York, N. Y. $1 per year; 10 cents per copy. Entered as second-class matter, October, 1926 issue. Vol. 8, No. 19, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

TECHNOLOGY DEPT.

The Editor Notes - -



A Platform for
AMERICAN BUSINESS

TO prevent a repetition of the world-wide business depression of 1930 and to restore and maintain conditions of prosperity, the McGraw-Hill Publishing Co., publisher of CONSTRUCTION METHODS and thirty-three other engineering and industrial journals, has formulated a Platform of Policies for American Business which appears as a supplement to this issue. The platform is built upon four main planks:

(1) Maintenance of established standards of living.

(2) Stabilization of future business growth.

(3) Promotion of international business cooperation.

(4) Encouragement of private initiative and responsibility as against extension of Governmental activity.

◆As a major American industry construction shares with other business and industrial groups the responsibility for putting into practice the principles enunciated in the platform.

◆It must be realized, of course, that the recommended platform is of such broad general scope as to include all business and that certain of its features have a more direct bearing upon other industries than they do upon construction. Nevertheless, a careful study of the principles is recommended to every engineer, every constructor and every manufacturer of construction equipment or materials, with the suggestion that each apply as many of the general principles as fit his own case.

◆A few of the subdivisions of the general platform which have the most direct relationship to the construction industry are those dealing with long-term planning, research and the development of new products and markets, sales control, modernization of plant, stabilized financing, coordination through technical and trade association work and establishment of standards of employment, salaries and wages to insure high standards of living and of purchasing power.

SO long as business activity is characterized by wide fluctuations in volume and price limits the gains in some groups are cancelled by losses to others and there is no net gain to the country as a whole. The interests of the speculative and creditor groups should be subordinated to the interests of those concerned with the production and distribution of goods and services, as typified by the engineer, the contractor and the manufacturer of construction equipment and materials. Such groups should have a larger measure of leadership in business policy to insure the sound and lasting national prosperity which will result from a general adoption of the Platform for American Business and an early and country-wide application of its principles.

CONSTRUCTION METHODS
A monthly review of modern construction practice and equipment

ROBERT K. TOMLIN, *Editor*
Editorial Staff
VINCENT B. SMITH NELLE FITZGERALD
J. I. BALLARD (San Francisco)

WILLARD CHEVALIER, *Publishing Director*

A McGraw-Hill Publication
Tenth Avenue at 36th Street, New York

A Trio to Tell our Story

WE shall let three more celebrated figures write this month's page for us. The first of these is Leonor F. Loree, president of the Delaware & Hudson Company. In his article published in the March *System* he says:

> "Of course we must concede that a man's career is shaped, in large measure, by chance. The important point is that he be trained and equipped, ready for the breaks that come his way."

Our next contributor is Charles M. Schwab, chairman of the Bethlehem Steel Corporation. He tells us:

> "Welcome new ideas. To establish permanent institutions we must always be prepared for change. Never be satisfied that what has been achieved is sufficient. Smugness and complacency do not promote progress."

And finally, no less a personage than Will Rogers, who broadcasts from his Beverly Hills observation post as follows:

> "You know you can't just stick up somebody's name and expect people to come flocking in nowadays. It don't only take persuading, it takes force. You can have Columnist Coolidge do a skit with Greta Garbo but still somebody has got to sandbag 'em to get 'em to pay real dough to see it.
>
> We are living in an age of "urge." We do nothing till somebody shoves us."

It's good to have these authorities endorse the *Construction Methods* story. For it is our ambition to help our readers to be "trained and equipped ready for the breaks that come their way" and to provide them monthly with a store of new ideas that will forestall complacency and promote progress.

And because so much of construction progress is due to the influence of modern materials and equipment, we provide also in our advertising pages a place for the manufacturer to contribute that all-essential "urge," for which Will has spoken so forcefully.

Willard Chevalier
Publishing Director

McGRAW-HILL PUBLISHING COMPANY, INC., TENTH AVENUE AT 36TH STREET, NEW YORK, N. Y.

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IN THE WEST VIRGINIA MOUNTAINS

the successful use of Crusca continues

AT Peter's Creek, W. Va., A. Guthrie & Co., Inc., are using CRUSCA Drill Steel exclusively on the Koontz Bend railroad tunnel project.

Chas. M. Faulkner, superintendent in charge, gives his opinion of the meritorious use of CRUSCA, as follows—

Higher praise could not be given

"It is a fact that we used Crucible Steel exclusively, and both on this work and formerly have found it to be highly satisfactory. We assure you that we have nothing but praise for Crucible."

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Tidewater Stone and Supply Company, Hackensack, New Jersey, have owned Autocars for 9 years. Their latest Autocar is this Model C, which is the model especially designed for carrying rotating concrete-mixer bodies. Tidewater's Model C Autocar is mounted with 3½ yard Rex body, is rated at 3½-5 tons, has a wheelbase of 186 inches and 10.50-24 balloon tires, dual rears. Its power plant is the Autocar Blue Streak Six.

IF YOU WANT THE FULL PROFITS OF THE MODERN CONCRETE-MERCHANDISING METHOD . . . USE AUTOCAR MODEL C

AUTOCAR TRUCKS, precision-built throughout, have the ruggedness to meet the unusual strains imposed by rotating concrete-mixer bodies. The 101-horsepower Autocar "Blue Streak" 6-cylinder engine that powers them has the strength to put the largest of these bodies at the "spot of pour", wherever that spot happens to be.

If you are a contractor, see whether your supply dealer uses Model C Autocars in delivering ready-mixed or truck-mixed concrete to your jobs. That fact in itself will indicate that he can give you this modern service at the lowest cost in the long run.

If you are a supply dealer seeking to participate in the profits of this new merchandising opportunity, get wise to Autocar Model C and the various types of mixer and agitator bodies available for use on it. Write today for detailed information.

AUTOCAR TRUCKS

PRECISION BUILT

THE AUTOCAR COMPANY, *Ardmore, Pa.*

The Close-Quarter Independent Crowd

gives you what the ordinary crowd gives and more

THIS IS PAGE 5

HANDLE 25% HARDER DIGGING

CROWD and hoist at the same time without splitting the engine power—without any loss of digging force! Reach out beyond the boom to the truck without the hoist pulling against the crowd! Secure 25% more digging force at the dipper lip and handle 25% harder digging!

—all with a simple mechanism free from chains, racks, and pinions!

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CM3 Gray

Out beyond the boom with a load of rock on a tough road job.

NORTHWEST

CLYDE HOISTS - DERRICKS

ENTIRE SATISFACTION

Wherever you find Clyde Hoists in use, satisfaction will prevail both among the contractors and their operators. The former appreciate the low operating and maintenance costs, the latter praise the easy operation and the strength and power found in every Clyde Hoist.

Below is shown the construction of the 17-story William Oliver office building in Atlanta, Ga., by the Southern Ferro Concrete Co. A Clyde gasoline hoist handled all concrete and iron work on this job.

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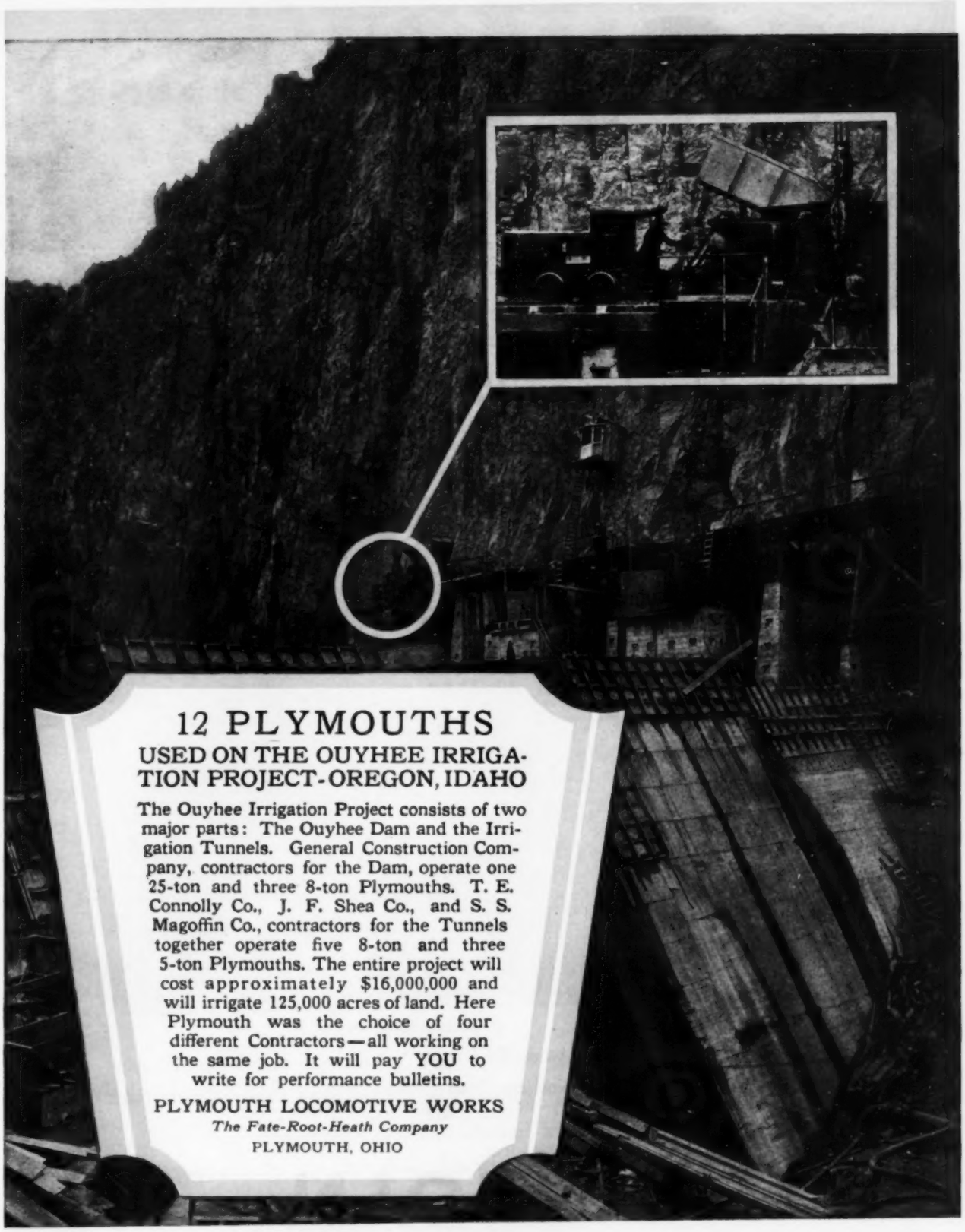
CLYDE TWO MARKS OF GUARANTEED QUALITY SUCCESSFUL PERFORMANCE CHICAGO



12 PLYMOUTHS

USED ON THE OUYHEE IRRIGATION PROJECT - OREGON, IDAHO

The Ouyhee Irrigation Project consists of two major parts: The Ouyhee Dam and the Irrigation Tunnels. General Construction Company, contractors for the Dam, operate one 25-ton and three 8-ton Plymouths. T. E. Connolly Co., J. F. Shea Co., and S. S. Magoffin Co., contractors for the Tunnels together operate five 8-ton and three 5-ton Plymouths. The entire project will cost approximately $16,000,000 and will irrigate 125,000 acres of land. Here Plymouth was the choice of four different Contractors—all working on the same job. It will pay **YOU** to write for performance bulletins.

PLYMOUTH LOCOMOTIVE WORKS

The Fate-Root-Heath Company

PLYMOUTH, OHIO

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Gasoline and Diesel Locomotives

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SHIELDED ARC

"I've learned something about arc welding during the last four or five years, but this SHIELDED ARC business is brand new to me.

What's it all about?"

"About the smartest development that's ever happened in welding. A Lincoln development, of course. Without going into the technical details of how it is secured, SHIELDED ARC simply means an arc which is allowed to do its best unhampered by influences which retard an unshielded arc's performance."

"But what I want to know is, what IS this shield. Is it some mechanical air-tight device?"

"No, . . . a chemical one. In a word, it is the building up around the arc of a gas area which oxygen cannot penetrate (get that word CANNOT) because when the oxygen hits the gas it isn't oxygen any more. WITHOUT that shield oxides and nitrides nestle in the weld and breed corrosion."

"What you're trying to fit on my non-technical head is that these nitrides and oxides are gangsters that are exacting toll from this welding business and that this shielded arc is as good as a police force in keeping them out."

"No, Pop, BETTER—and typically."

LINCOLN

W-170

A product of the largest manufacturers of Arc Welding Equipment in the World

THE LINCOLN ELECTRIC COMPANY, CLEVELAND, OHIO

Profits *where the dirt is* Thin!

On those shallow grading jobs where the pay dirt is spread out thin—there is where you will appreciate a Bucyrus-Erie!

This Bucyrus-Erie gasoline shovel is leaving a floor practically ready to lay the slab. Its big, sure-acting clutches and brakes give the operator a "feel" that enables him to split an inch where he wants to and still maintain a high rate of output all day long. ***Send for catalog on any size.***

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RIVETS ARE NOT IN TENSION

In every rail of Heltzel Superior Lock Road Forms, twenty-two husky rivets, each 7/16 in. in diameter, are used. These extra large rivets are tough, and will not shear in normal use. In addition, Heltzel Superior Lock Road Forms are so designed that no rivets are in tension. One common fault of ordinary steel road forms has been the ease with which rivets pulled loose. Such trouble is impossible with Heltzel Superior Lock Road Forms.

Heltzel Forms have many other advantageous features.

Write today for full information.

EXTRA RIGIDITY

With 8 in. base form

All Heltzel Superior Lock Road Forms 8 in. or more in height can be furnished for immediate shipment with an 8-in. base. The use of this extra wide base increases the rigidity of the form, prevents form settlement, and eliminates the tendency of road forms to sway under the finishing machine.

The HELTZEL Steel Form & Iron Co.

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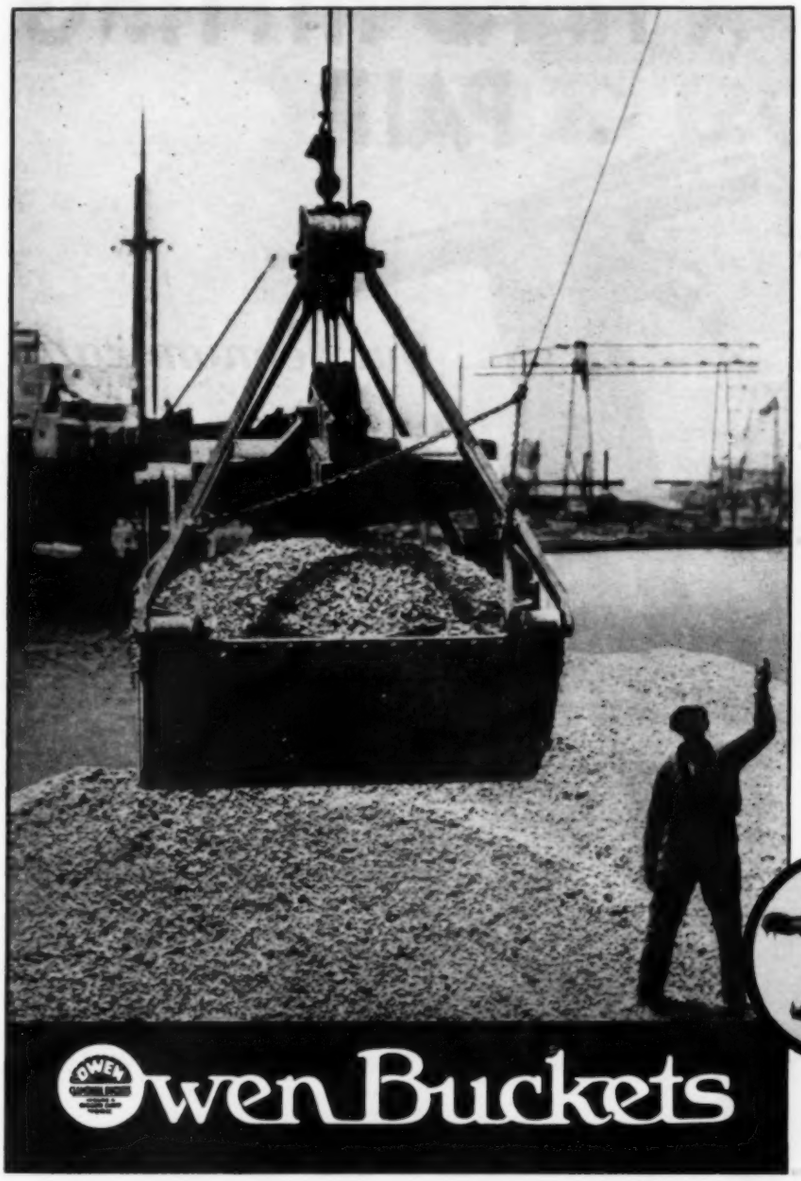
IS YOUR BUCKET OBSOLETE



« *when*

YOU CAN REPLACE IT WITH ONE THAT DOES MORE WORK IN LESS TIME AT A LOWER COST....

Owen Buckets

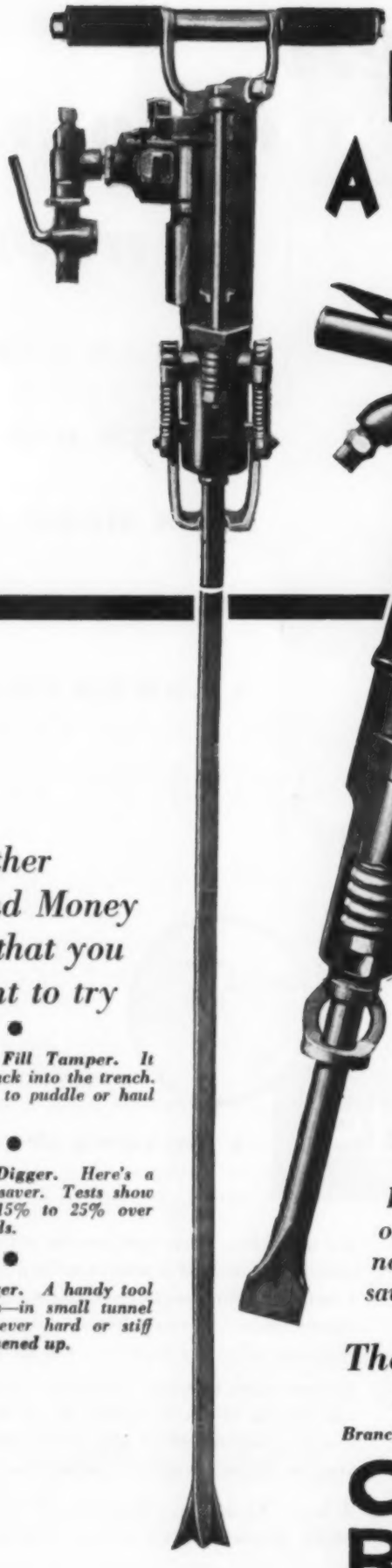
A MOUTHFUL AT EVERY BITE

Investing in an Owen is like spending one dollar to make two. It is a money-making producer from the very start. It speeds up results at once. It cuts down labor costs. It increases yardage per hour. It handles more jobs per week, because it does "a bigger day's work than any other bucket of the same weight and capacity." And that's a positive guarantee that has been attached to every Owen Bucket ever sold.

Ask any Owen owner whether that guarantee holds good. Then try an Owen yourself. Compare the operating costs and results with those of your present bucket. If it proves to be a better worker—a better paying bucket—doing a bigger job in less time—then we won't have to convince you that you can afford to replace with an Owen.

Do you want to know where, in your vicinity, you can see an Owen at work? Write us, and we will direct you—also send you some specific information on Owen Bucket construction.

The Owen Bucket Company
6023 Breakwater Ave., Cleveland, Ohio



H7 *and* C7 A HARD HITTING PAIR

but economical on air . . .

The best thing said about these two tools is said by the men who use them.

They're well liked—for the H7 Sinker and the C7 Paving Breaker go places and get things done in less time and with less trouble.

Their power is unusual—but their low air consumption is a factor that appeals to the man who watches costs.

If you want to see what they can do for you on your work we'll gladly demonstrate. There's no obligation and it can mean real, bona fide savings on that job.

Three other Cleveland Money Makers that you will want to try

●

No. 5B Back Fill Tamper. *It rams the dirt back into the trench. You don't have to puddle or haul the dirt away.*

●

TD5 Trench Digger. *Here's a sure fire labor saver. Tests show it saves from 15% to 25% over ordinary methods.*

●

CD5 Clay Digger. *A handy tool for close places—in small tunnel work and wherever hard or stiff clay is to be loosened up.*

***The* Cleveland Rock Drill Co.**

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CLEVELAND ROCK DRILLS

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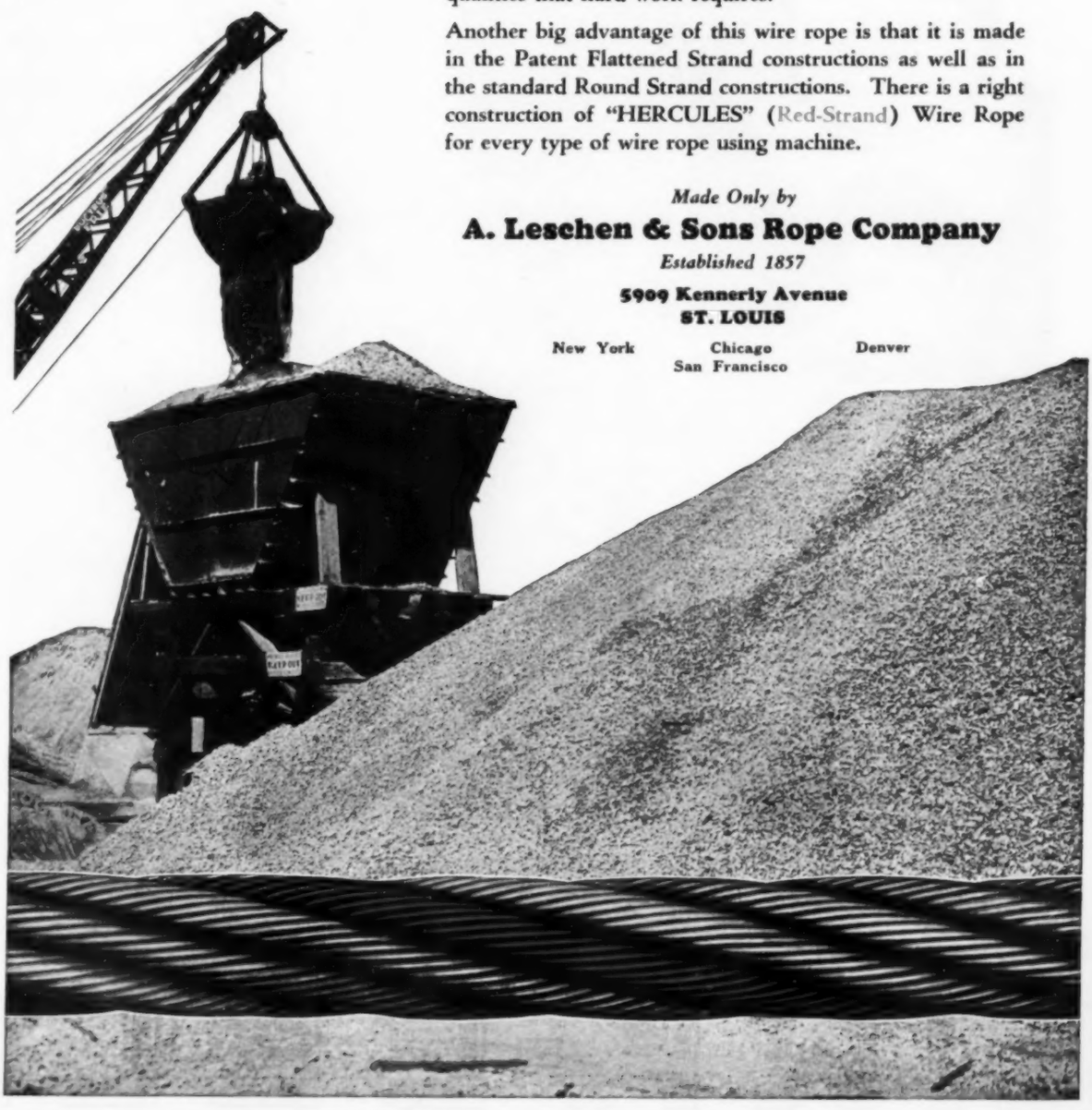
WIRE ROPE

A TRUE measure of value is "the amount of service that an article gives for each dollar of its cost," and this is the yard-stick that we would like to have you apply to "HERCULES" (Red-Strand) Wire Rope.

"HERCULES" is an economical wire rope because it possesses in proper balance and to a correct degree, all of the qualities that hard work requires.

Another big advantage of this wire rope is that it is made in the Patent Flattened Strand constructions as well as in the standard Round Strand constructions. There is a right construction of "HERCULES" (Red-Strand) Wire Rope for every type of wire rope using machine.



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ON JOB AFTER JOB

THE Torson Construction Co., Kansas City, used one of their economical and dependable Link-Belt Shovels on this job for digging a 2440 ft. trench, 12 ft. deep and 13 ft. wide, through soapstone, clay and rocks.

The machine also handled the 9-ton sections of concrete pipe from the casting yard into place on the trench bottom.

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All-the-Way-Through Quality AIDS THE CONTRACTOR

ANY digging machine can do the ordinary jobs of excavating or grading. It is the *tough* jobs where steady performance is required that tell the story of shovel efficiency.

This efficiency is not merely a matter of power, or ruggedness, or stability, or any other single feature. It is a combination of all of them, properly co-ordinated in the one design.

Balanced quality of design—good throughout—is a characteristic of the Link-Belt Shovel-Crane-Dragline. It is the Link-Belt idea to build this equipment *uniform,* with a design that includes no "trick" feature, and with no parts below par.

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"Our CABLE COSTS are cut to half—"

"Since we started using the bucket *without side leads*"!

THE men who have kept actual records know this: The bucket *without side leads* is by far the most economical on cable.

One user writes: "Renewals of cable and sheaves on our WILLIAMS are about half of those required with other buckets." (Name and details on request.)

To get away from side leads of cable on the WILLIAMS "Champion," we reverse the bend around the return sheave. Cable is made to bend, but not to pull sideways against sheave flanges. *Besides, our straight reeving distributes the wear to twice as much surface on the closing cable.*

See for yourself, on your own work, how the WILLIAMS "Champion" saves you money on cable. *A real Champion welcomes competition!*

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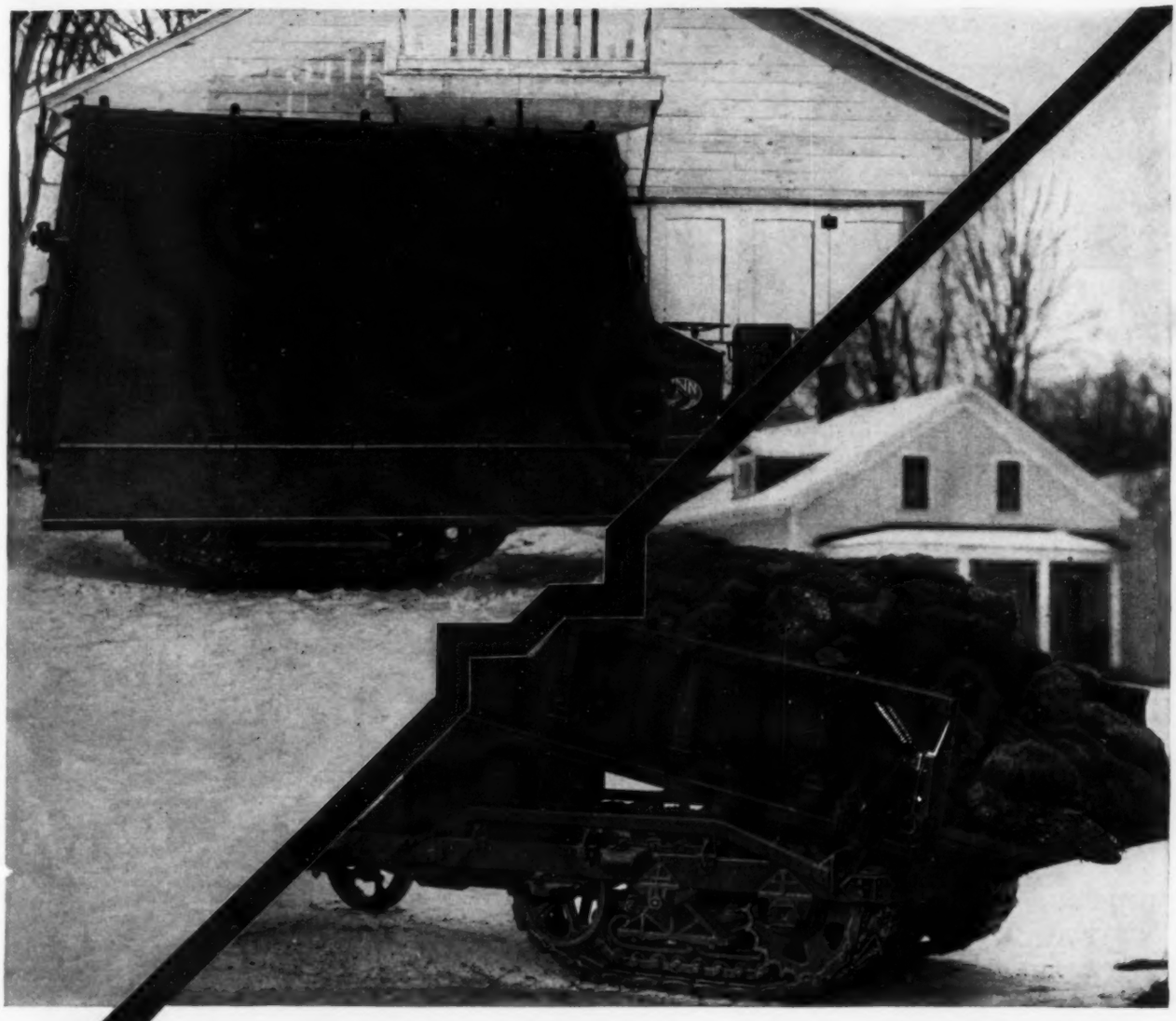

LINN FOR CERTIFIED TRANSPORTATION

More than a truck—more than a tractor, the NEW LINN provides *Certified Transportation.*

Full speed reverse or full speed forward—in places too narrow for ordinary truck or tractor to turn in—LINNS carry and dump *automatically* a ten ton pay load . . . to the right . . . left . . . or rear.

The NEW LINN Elevating Grader Body (complete specifications on request) saves time and speeds up any job. LINN'S sturdy tail board—another new LINN feature for rear dumping—lifts and locks automatically. These features combined with the wide, ground gripping tracks, made of increasingly durable 12% manganese steel, which maintains full contact with the road surface—mean *transportation plus.*

LINN'S moving anti-friction contained roller chain system, transferring the full weight of the machine and pay load to the ground, spares axle and axle bearing in the rear drive of wear and tear . . . and the dependable 100 h. p. motor is capable of towing 25 to 100 tons, conditions considered.

LINN TRACTORS

Patent No. 1,270,531
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Patent No. 1,685,641
Patent No. 1,686,676
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Exclusive LINN features, all of these, are reasons why LINN completes tough jobs that baffle ordinary machines.

A substantial reduction in the prices of LINN tractors is now in effect

LINN MANUFACTURING CORPORATION

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Only HAUCK has "Slide-Rail" Heat Control. Simply push burner toward kettle for more heat—pull out for less.

HAUCK
OIL BURNERS

A HAUCK heats up *in half the time required by wood*

HAUCK kettles work fast. The powerful burner gets up full heat in five minutes, starting cold. No long delay while "firing up." Burns kerosene, coal oil or any light furnace oil—costs *less* for fuel.

Saves labor, too. No hunting for wood or waiting for coal. No stoking. No attention needed to keep your material *hot*. No smoke, no sparks, no ashes. No danger of "coking" the asphalt, for the powerful heat is *controlled* . . . instantly regulated without turning a valve. A HAUCK is handy. Loosen one strap and you have a portable torch . . . take off the burner and tank and carry them anywhere. The oil burner equipment and kettle throughout are designed for dependable and satisfactory service.

HAUCK MANUFACTURING COMPANY

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Branch Offices and Warehouses in Chicago and San Francisco

SEND FOR THE NEW HAUCK CATALOG

Investigate . . . get set to bid low and still make money on this biggest road program in history. New Catalog just issued shows complete HAUCK line of special construction heating equipment . . . prices, capacities, performance facts. Send the coupon now.

HAUCK MANUFACTURING COMPANY
101-111 Eleventh St., Brooklyn, N. Y.

Gentlemen: Please send me the new catalog of Hauck Oil Burning Equipment for General and Highway Construction and Maintenance.

Names and Title .....

Company .....

Street and City .....

Roller bearings on all Hauck wheeled kettles. Built for fast long-distance trailing. Furnished also with legs only. Capacities 25 to 165 gallons; cost as little as $95 complete.

Other Hauck money-savers for construction and maintenance work are listed below. Shrewd road builders all over the country are using them. Every piece of Hauck equipment is built to *last* and backed by 31 years of practical experience in construction and industrial oil heating work. Send for detailed information and prices.

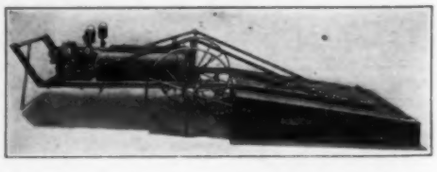
- Lead and Compound Melting Furnaces
- Combination Asphalt Cement and Tool Heaters
- Asphalt Surface Heaters—Kerosene and Fuel Oil
- Portable Torch Equipment for all purposes
- Circular and Straight Flame Burner Equipment
- Flame Thawing Equipment.
- Concrete Mixer Heaters
- Water Heaters for concrete work
- Salamanders—oil burning
- Brush-Burning Torches
- Weed Burners

Hauck Tool Heater

Heats tampers and smoothers; heats binder cement; three burners; fast and economical.

Hauck Surface Heater

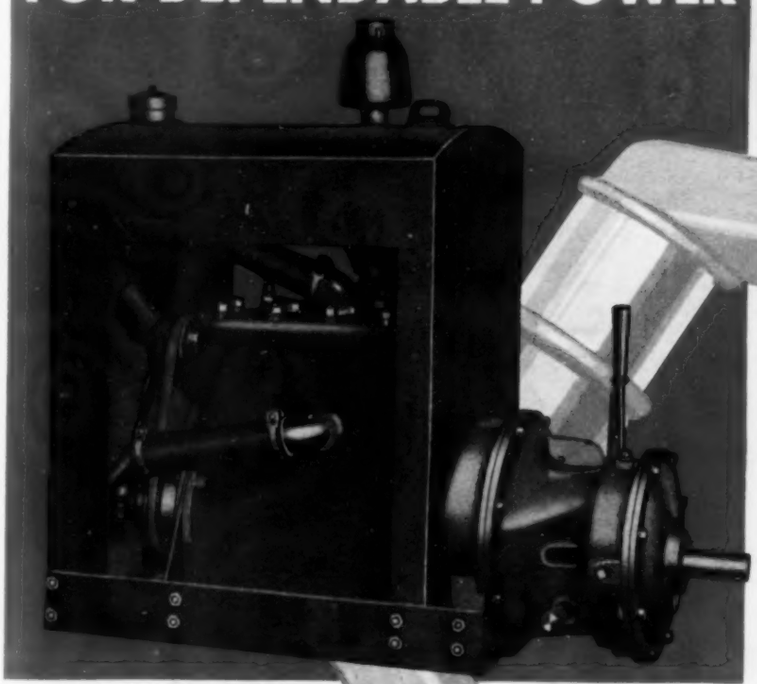
for patching—saves time, labor, material, fuel.



LE ROI'S CRANKSHAFT GUARANTEE

is reflected in LOW maintenance cost

FOR DEPENDABLE POWER



Your power demands might never test the full strength of a LeRoi but you can be sure of getting real service at the lowest possible cost . . . always. A LeRoi gives you maximum power under full load. It is steady, efficient, dependable . . . and its reserve stamina pulls many a job through . . .

LeRoi is so sure of its high quality materials and construction that every crankshaft (the backbone) is guaranteed for the life of the engine. This added advantage means steady profitable performance from your equipment. LeRoi is the power of wide acceptance . . . tried, tested and proven. Now it gives you even more, a guarantee that means much.

LE ROI COMPANY, *Milwaukee, Wisconsin*

LE ROI ENGINES

Cuts Out the Nibbling

KOEHRING Independent Crowd and Hoist lets operator distribute the power so as to obtain best results and even, when necessary, to put full power behind *either* crowd or hoist.

Dipper does not jump away from hard spots—

It cuts out "nibbling" on the tough jobs, one of the biggest time wasters of shovel operation!

Koehring capacities are rated on line-of-plate *"struck"* measure—The "heap" is yours as extra capacity "pay-dirt"!

FingerTip ease of control—secured without mechanical complications or loss of the "feel" of the load so essential to confident, accurate, high-speed operation. Ask for Shovel catalog!

Truck—Tractor—Bulldozer

That's the Koehring Dumptor! A broad, capacious load-carrying steel body on oversize multiplanes that take the load over tough "going"—

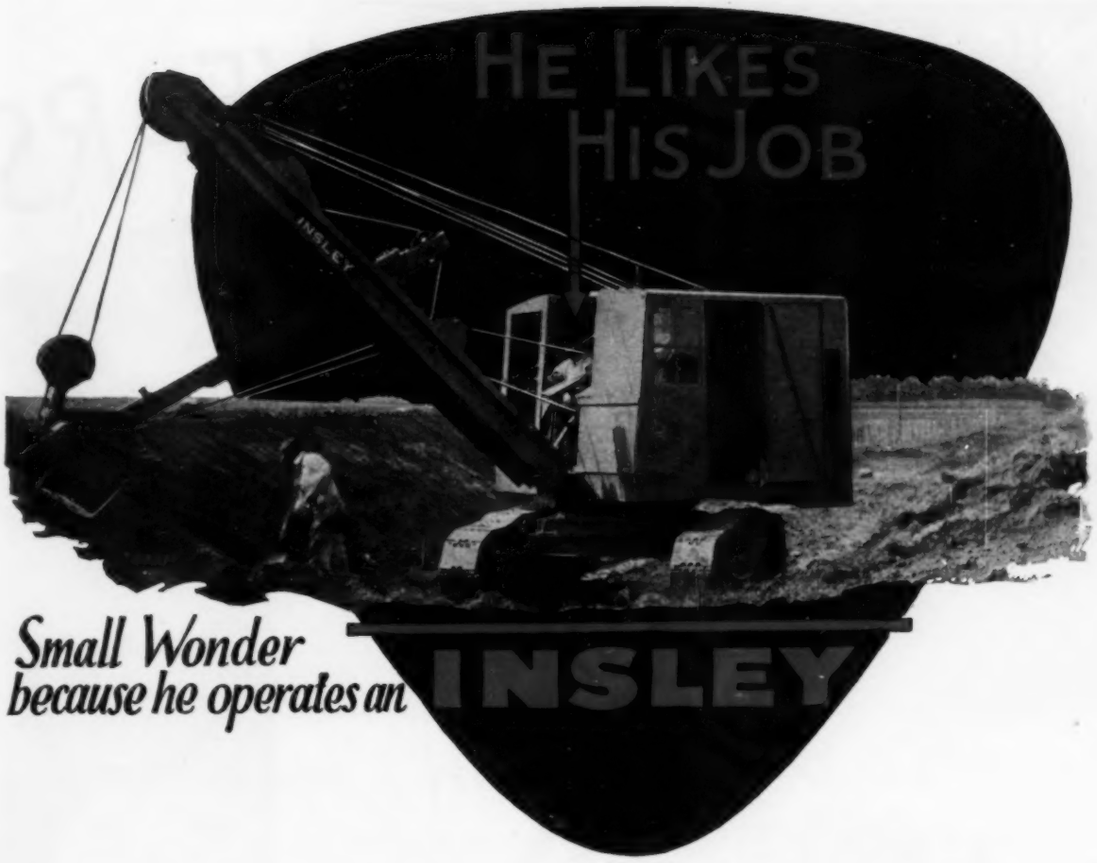
Two four-cylinder engines, one for each multiplane; selective steering, either throttle or brake. One man operation. Load *ahead* of the driver. He sees where he dumps, and body in dumping position does the "bulldozing". Backs away from dump before turning! Capacity 5 cu. yds.

National Equipment Corporation

NEC

A 6203-I

Milwaukee



Small Wonder because he operates an **INSLEY**

AND the Half Yard Insley is designed especially to suit his taste in shovels.

From where he sits, everything is within reach. He doesn't have to get up and roam around to shift a lever here or drop in a dog there. It is all right there before him—the hoist drums, the swing, both traction clutches and brakes. He can dig a yard a minute—can climb a steep hill—steer either to the right or left—anything that he is required to do, and never leave his seat.

He doesn't have to spend an hour a day fiddling with clutch adjustments. He adjusts his Insley drum clutch in five minutes and it stays that way for a week. He doesn't have to change clutch lining every other month—in fact he doesn't have to change lining at all, because when an Insley clutch lining is put on it stays put indefinitely!

And such a clutch! Easy to handle? He can slip it—shove it on—hold his load on the clutch if necessary—in fact he can do tricks with an Insley clutch that he never could do with any other machine he ever worked on. And that all helps when he is making speed—moving yardage fast—hitting the ball.

And speed? He never worked on a faster machine. And yet it is so easy to handle that he can sit there all day, never slow down for a minute, keep it wide open, and feel fresh as a daisy at quitting time.

He knows his Insley makes money for the boss—that it makes money for him—that it doesn't wear him out—far from it—and that he enjoys running it. Small wonder that he likes his job.

All you have to do is to ask him and he'll tell you—any Insley operator—that he would rather work on an Insley than any piece of similar equipment he ever saw.

804

National Equipment Corporation

N. 30th St. and W. Concordia Ave. *Milwaukee*

AMERICAN
«GOPHER»

OUT OF THE EXPERIENCE OF 48 YEARS

Quality Engineering

The Granite Bituminous Paving Co. of St. Louis, Mo., use their "AMERICAN GOPHER" mainly for street grading work in advance of new paving. In the shallow cutting usually associated with this work the "GOPHER" has shown ability to get out a high hourly yardage and ruggedness enough to break up and load old pavement economically. When tearing up old block pavement the machine usually breaks up and loads 190 to 200 square yards of pavement an hour.

AMERICAN

The Name is Important

HOIST & DERRICK CO.

Saint Paul, Minnesota

ASSOCIATE COMPANY

DOMINION HOIST & SHOVEL CO., Ltd.,

MONTREAL, CANADA

Their Report Card is Yours—Send the Coupon

THREE were water-cooled machines of standard make; the other was a stock Davey Air-Cooled Compressor. All were trailer-mounted.

They were put through a grinding series of competitive tests by two engineers who are members of the teaching staff in the Mechanical Engineering Department at Case School of Applied Science, Cleveland.

Each of the four Compressors was tested impartially. Each was submitted to the same careful *examinations* of engineering design and construction; to the same exacting *analysis* of daily performance; to the same long, hard, thorough *tests—equal to 16 grinding weeks of work out on the job.*

The air-cooled "Davey" won authentic engineering approval and consideration just as it has won the approval of practical contractors.

For you we sent these four portable air compressors to "school." For you these engineers ran fair, unprejudiced tests. For you these facts are now compiled in an illustrated booklet—a copy is waiting to be sent to you. It's as near to you as this coupon and the closest mail box. Write for it, without obligating yourself, today!

DAVEY COMPRESSOR COMPANY, Inc., Kent, Ohio
Sales Representatives in All Principal Cities

DAVEY COMPRESSOR COMPANY, Inc., Kent, Ohio
Send me the report of the 500 hour competitive tests in the booklet "Four Air Compressors Went to School."

Name.....

Address.....

Post Office..... State.....

Company..... Position.....

C. M.

DAVEY AIR COOLED AIR Compressors

Always the Last Word

Blaw-Knox answers the demands of highway engineers and contractors with a sturdy and rugged 8″ base form —for 8″ heights and upwards.

There's more to it than just a 2″ wider base—examine the superior features of this 8″ base Blaw-Knox Road Form.

Adhering to the 18 year old *proved* basic principles of road form design which all road builders know and value—

THE STAKING SYSTEM *stays put.*
Its effective keying action gives a positive tight grip between the form and the stake.

THE LOCK-JOINT *takes out waves in the road*
Unyielding, rigid and easy to operate—longer and stronger. Designed to negotiate curves in the road.

Blaw-Knox Road Forms are built to withstand abuse. They are constantly being improved to keep abreast of the continual changes in road paving methods and machinery.

Blaw-Knox Standard Dreadnaught Road Forms with the 6″ base will be furnished when desired.

Your 1931 requirements can be shipped *now.*

BLAW-KNOX COMPANY
2086 FARMERS BANK BUILDING, PITTSBURGH, PA.

New York Chicago Cleveland Detroit Philadelphia
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EXPORT DIVISION:
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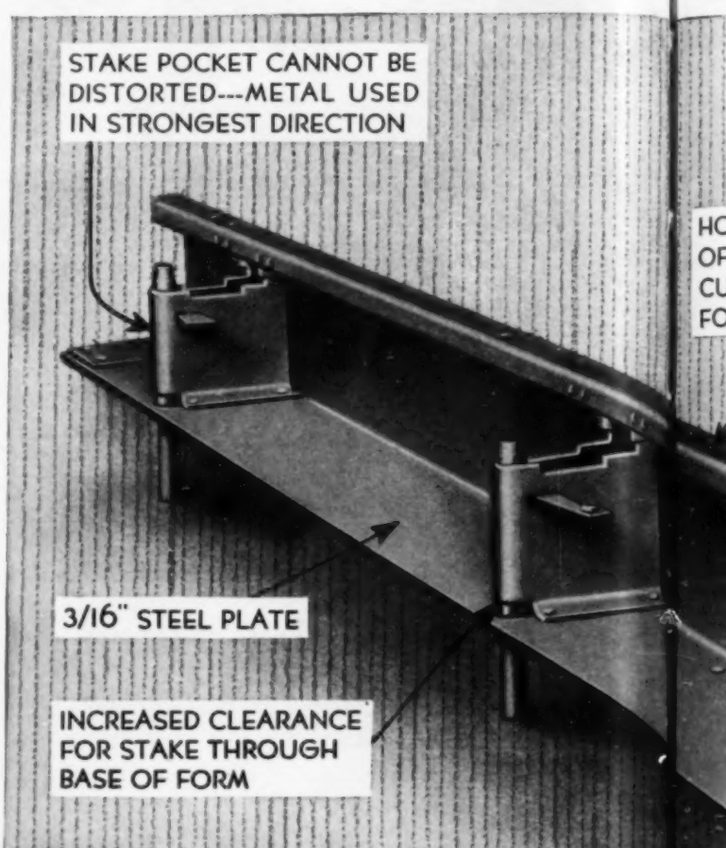
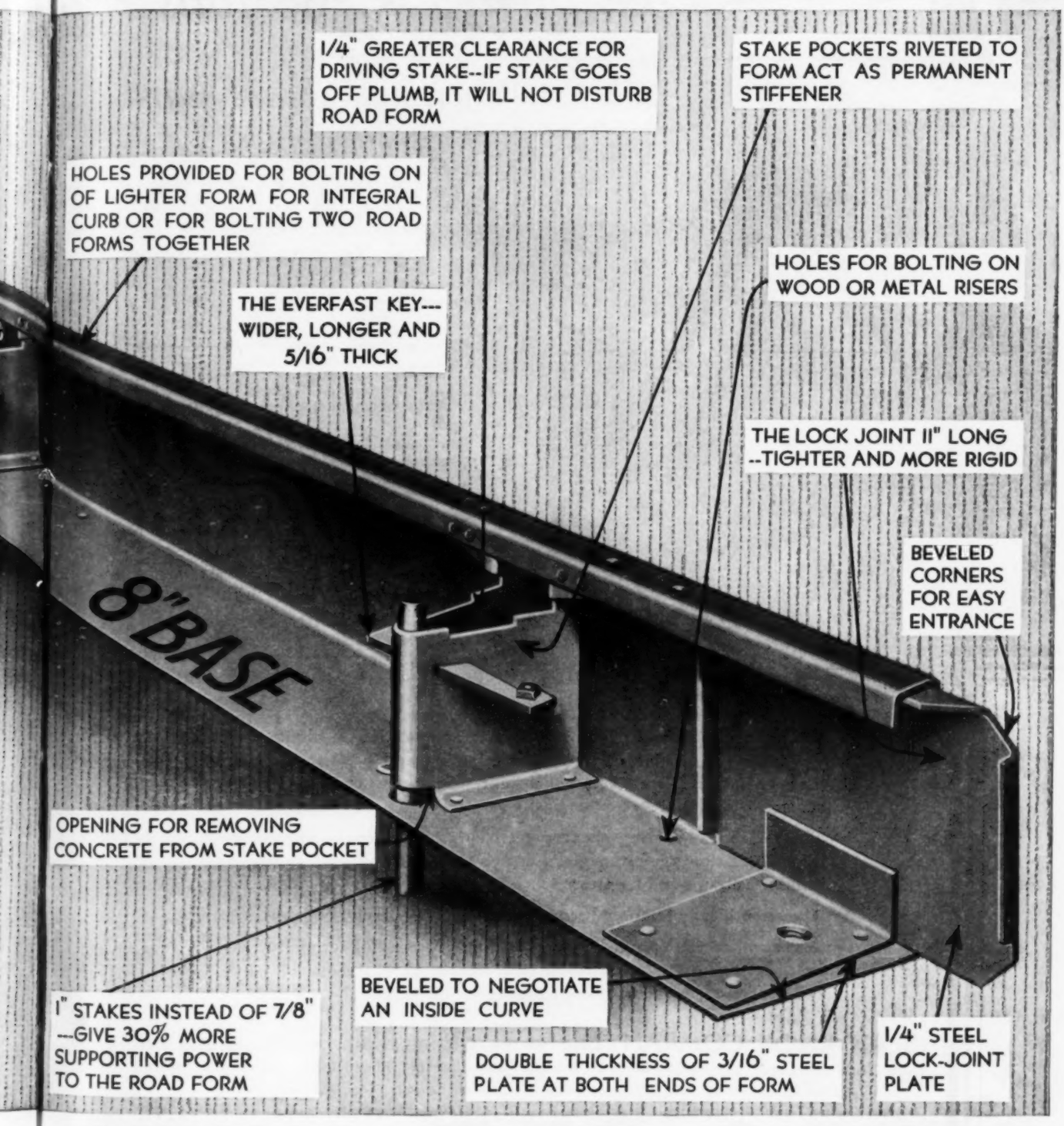

STAKE POCKET CANNOT BE DISTORTED---METAL USED IN STRONGEST DIRECTION
3/16" STEEL PLATE
INCREASED CLEARANCE FOR STAKE THROUGH BASE OF FORM

A good combination for maximum paving production—Blaw-Knox Road Forms and the ORD Double Screed Finisher, to which a Tamper will be added if desired.

BLAW-KNOX

Manufacturers of Road Forms—Ord Road Finishers—Batcherplants—Weighing Batchers Volume Batchers—The Cementank—Bulk Cement Plants—Wagon Graders—Steel Forms for Streets and Sidewalks—Truck Turntables—Nu-Method Finish Grader—The Inundation System—Clamshell and Dragline Buckets—Ready Mixed Concrete Plants—Truck Bodies.

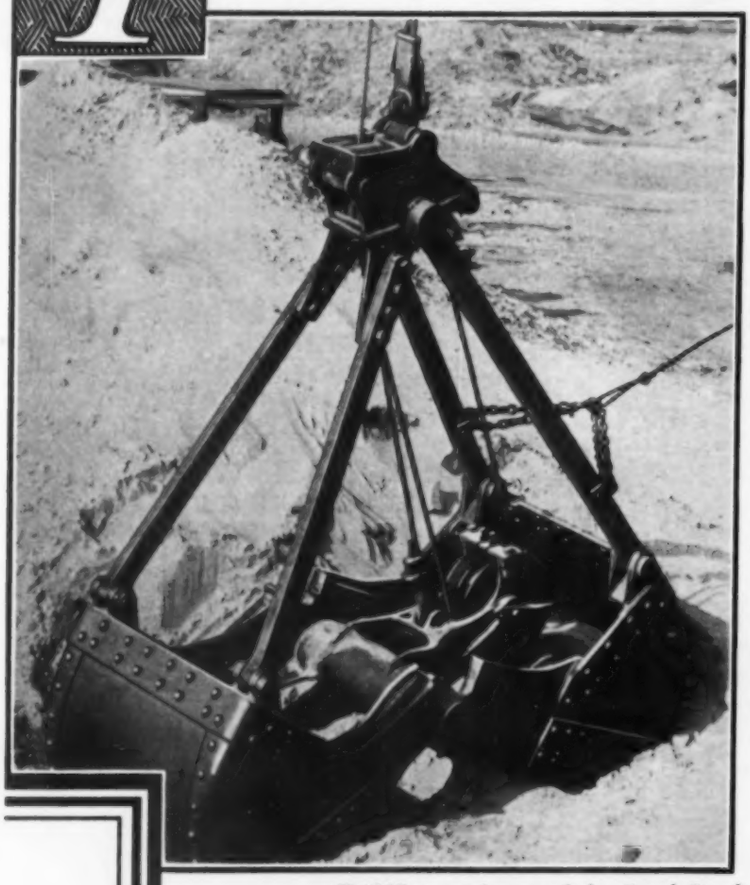
in ROAD FORMS


1/4" GREATER CLEARANCE FOR DRIVING STAKE--IF STAKE GOES OFF PLUMB, IT WILL NOT DISTURB ROAD FORM
STAKE POCKETS RIVETED TO FORM ACT AS PERMANENT STIFFENER
HOLES PROVIDED FOR BOLTING ON OF LIGHTER FORM FOR INTEGRAL CURB OR FOR BOLTING TWO ROAD FORMS TOGETHER
HOLES FOR BOLTING ON WOOD OR METAL RISERS
THE EVERFAST KEY--- WIDER, LONGER AND 5/16" THICK
THE LOCK JOINT 11" LONG --TIGHTER AND MORE RIGID
8" BASE
BEVELED CORNERS FOR EASY ENTRANCE
OPENING FOR REMOVING CONCRETE FROM STAKE POCKET
1" STAKES INSTEAD OF 7/8" ---GIVE 30% MORE SUPPORTING POWER TO THE ROAD FORM
BEVELED TO NEGOTIATE AN INSIDE CURVE
DOUBLE THICKNESS OF 3/16" STEEL PLATE AT BOTH ENDS OF FORM
1/4" STEEL LOCK-JOINT PLATE

AW-KNOX

This Blaw-Knox Bucket handled 275,368 tons

without sheave bearing replacement



11-18-30

The Blaw-Knox Company,
526 Union Building,
Cleveland, Ohio

Gentlemen:

We purchased from you on May 22nd, 1928, one three-quarter yard Clamshell bucket. This bucket has been in constant use since that date rehandling Port Crescent Lake Sand from stock piles to railroad cars and trucks. This sand is extremely fine and highly abrasive.

We have handled during that time a total of 275,368 net tons, and commend the use of this bucket to anyone desiring to handle similar materials. No replacement has ever been made of sheave bearings.

We also have a Blaw-Knox Digging bucket at one of our pits at Port Crescent, Michigan, where it is giving excellent satisfaction.

Very truly yours,
SAND PRODUCTS CORP.

(Signed) A. N. FARMER
Treasurer

THE experience of the Sand Products Corporation is common to all users of Blaw-Knox Ball Bearing Buckets because the vital parts in Blaw-Knox buckets, which represent nearly 80% of all bucket replacement, are protected against wear.

The sealed ball-bearing sheaves keep abrasive materials out—maintain lubrication against neglect, assure easy opening and closing—minimize strains and stresses.

The scientifically tempered scoop lips wear very slowly.

These and other improved features of Blaw-Knox Ball Bearing Buckets are described and illustrated in new catalog 1234 just issued. Ask our nearest office for your copy now.

BLAW-KNOX COMPANY 2086 Farmers Bank Bldg. - Pittsburgh, Pa.

New York Chicago Cleveland Detroit Buffalo Birmingham Philadelphia Baltimore Boston

EXPORT DIVISION: Blaw-Knox International Corporation, Canadian Pacific Building, New York

London, England, New Oxford House, Hart St., Holborn, W. C. I.—Paris, France, 1 Rue de Clichy—Milan, Italy, 6 via S. Agnese
6 Dusseldorf, Germany, 17 Bismarckstrasse.

BLAW-KNOX

Setting a New Standard of Torch Efficiency

There's nothing like the new Cleveland Flaming Torch. Its distinctly different design results in unusual economy and absolute dependability. The Flaming Torch burner achieves perfect vaporization and produces, with minimum oil consumption, a full, stable flame that burns under all conditions.

It is strongly built with reinforced grey iron base to stand abuse and eliminate breakage. Low center of gravity makes it stay put—it is almost impossible to tip it over accidentally. Holding three quarts of oil the Cleveland Flaming Torch burns 36 to 48 hours without a refill. That's real economy.

Another feature is its attractively low price. Thus, this unusual torch offers you both low first cost and continuously low fuel expense.

You will want to use the Cleveland Flaming Torch for its many advantages—for the savings it will bring you. A trial, under any circumstances you may wish to make it, will convince you.

Write us today for prices and further details.

Positive Protection

There's no uncertainty with Cleveland Flaming Torches. Under most adverse conditions they have continued to give a steady, highly visible flame for as long as 48 hours.

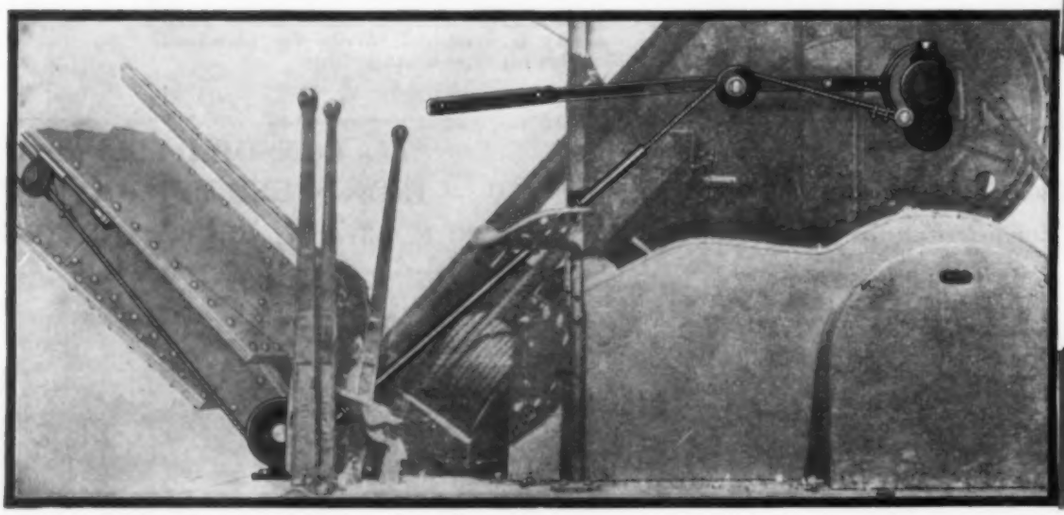
The new burner design not only provides perfect vaporization but shields the flame against wind, rain and snow.

DEALERS: Some desirable dealer territory is available. Write for Cleveland Flaming Torch proposition.

The CONSOLIDATED IRON-STEEL MFG. CO.
1290 E. 53rd St., CLEVELAND, OHIO

TRIFLES *make* PERFECTION

THE POWERFUL Center Drive design . . . plus unlimited attention to the hundreds of little details that make for smoother operation, greater ruggedness, greater safety and increased yardage . . . this is what Thew Lorain engineers put into Lorain machines. They realize that split-seconds saved on each pass of the dipper mount up to surprising totals in the course of the job. ▲ Listed here are a few of the many little details that save split seconds and increase output for the owners of Thew Lorain machines.



Tremendous Trifles

Automatic Crowd Brake
Automatically prevents back drift of the stick. Saves power. Saves the operator's time.

Booster Bands
Uses engine power instead of the operator's muscle to engage the clutches.

Swing Brake
Quicker, more accurate swing control.

Chain Crowd
High efficiency, positive transmission of power, self-adjusting to all boom angles.

Interchangeable Lagging
Flexibility that gives extra speed for easy digging . . . . extra power for tough digging.

Simplified Controls
In the shovel: 3 levers, 1 foot pedal. In the crane: 2 levers, 2 foot pedals.

Automatic Dipper Trip
Not necessary to take the hands off control levers . . . . . the engine trips the dipper. Good for 10 more truck loads a day.

Foot pedals
Automobile type—as comfortable as an old pair of shoes.

THEW-LORAIN
45 ·· 55 ·· 75

Automatic

DIPPER TRIP ▲ ▲ ▲ ▲ ▲ ▲

With both hands on the controls the operator can trip the dipper —a slight side pressure of the elbow on the dipper trip arm and the engine does the rest. This feature alone, according to operators, is good for 10 truck loads more a day. ▲ The Thew automatic dipper trip is positive and automatic in its operation. It is self-adjusting to all boom angles and will trip the dipper in any position.

THE THEW SHOVEL COMPANY, *Lorain, Ohio*

Pavement in new central yard of Hackensack Water Co., Hackensack, N. J. W. W. Gutteridge, engineer for the company; Jos. Kinzley Co., contractor, both of Hackensack.

High-Early-Strength Pavement Ready for Heavy Traffic in 3 Days

"The buildings in the new construction and store yard of the Hackensack Water Co. were completed only three days before the time set for operating this yard. It was therefore necessary to arrange for a pavement that would bear the traffic of heavy trucks within three days," writes W. W. Gutteridge, company engineer. "Concrete had already been chosen for paving and Universal Atlas high-early-strength concrete was used to meet the time limit."

At 3 days the concrete tested over 2000 lbs. per sq. in. in compressive strength and was ready for use. From 11 to 25 days of valuable working time was thus saved the water company.

High-early-strength concrete made with Universal Atlas methods and cement is used for concrete work which calls for speed, greater strength, watertightness and durability. A booklet containing methods for obtaining it will be sent on request.

Name_____

Address_____

Universal Atlas Cement Co.
208 South La Salle St., Chicago
Without obligation, please send me methods for securing Universal Atlas high-early-strength concrete. C. M. 3-31

63

Universal Atlas Cement Co.

Subsidiary of United States Steel Corporation

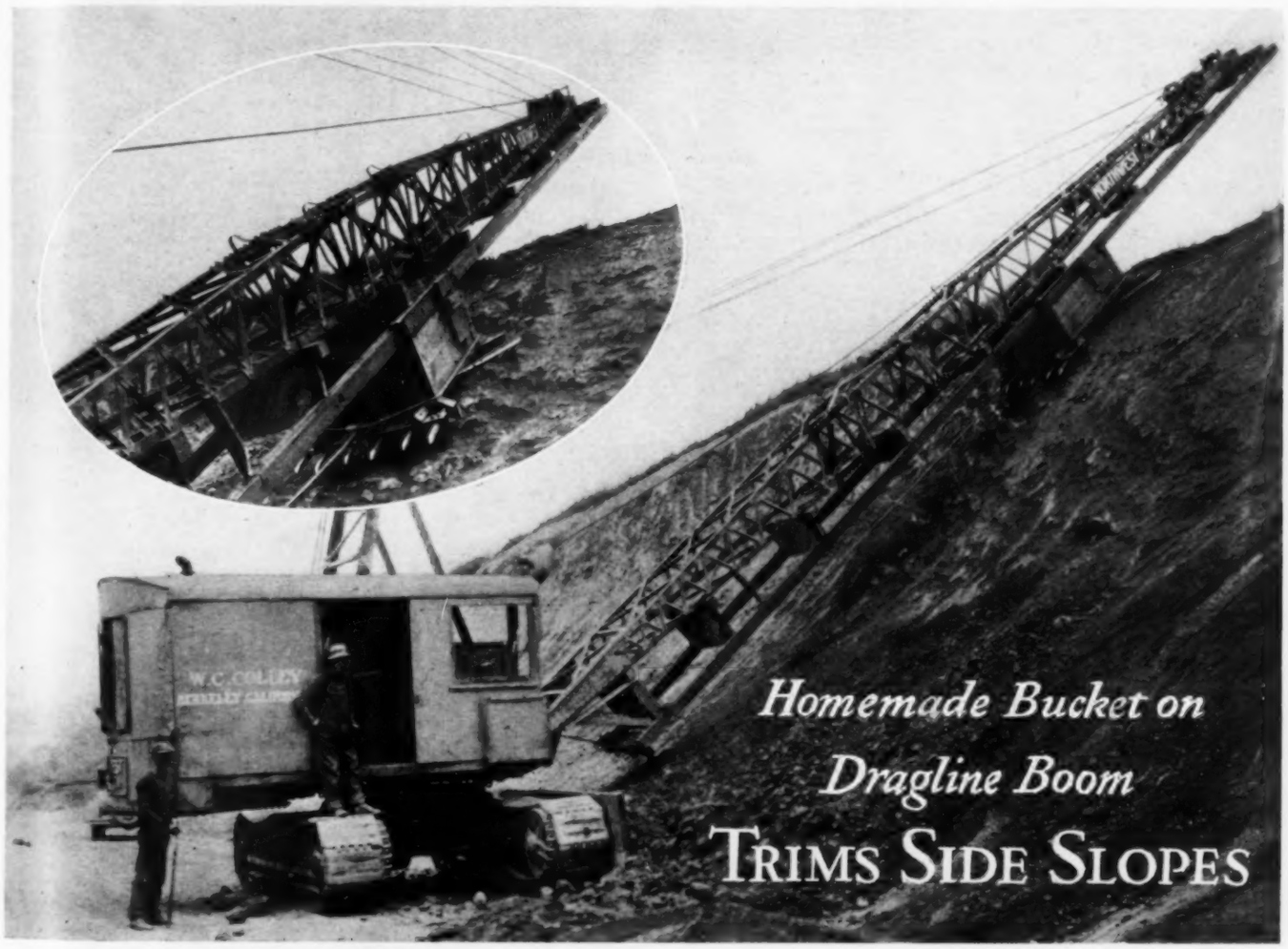
Concrete for Permanence

Construction Methods

A McGRAW-HILL PUBLICATION—ESTABLISHED 1919

ROBERT K. TOMLIN, *Editor*

VOLUME 13 | NEW YORK, MARCH, 1931 | NUMBER 3



Homemade Bucket on Dragline Boom TRIMS SIDE SLOPES

AN ECONOMICAL method of cutting slopes to exact line, developed by W. C. Colley, of Berkeley, on the grading of the Redwood highway in California, involves the use of a wooden box with scarifier teeth operating on a frame attached to the boom of a dragline. Re-sloping of the banks to a 1:1 slope provided a grading job which was particularly difficult to do economically by hand. The slopes varied up to a maximum of 65 ft. high and were from 300 to 700 ft. in length.

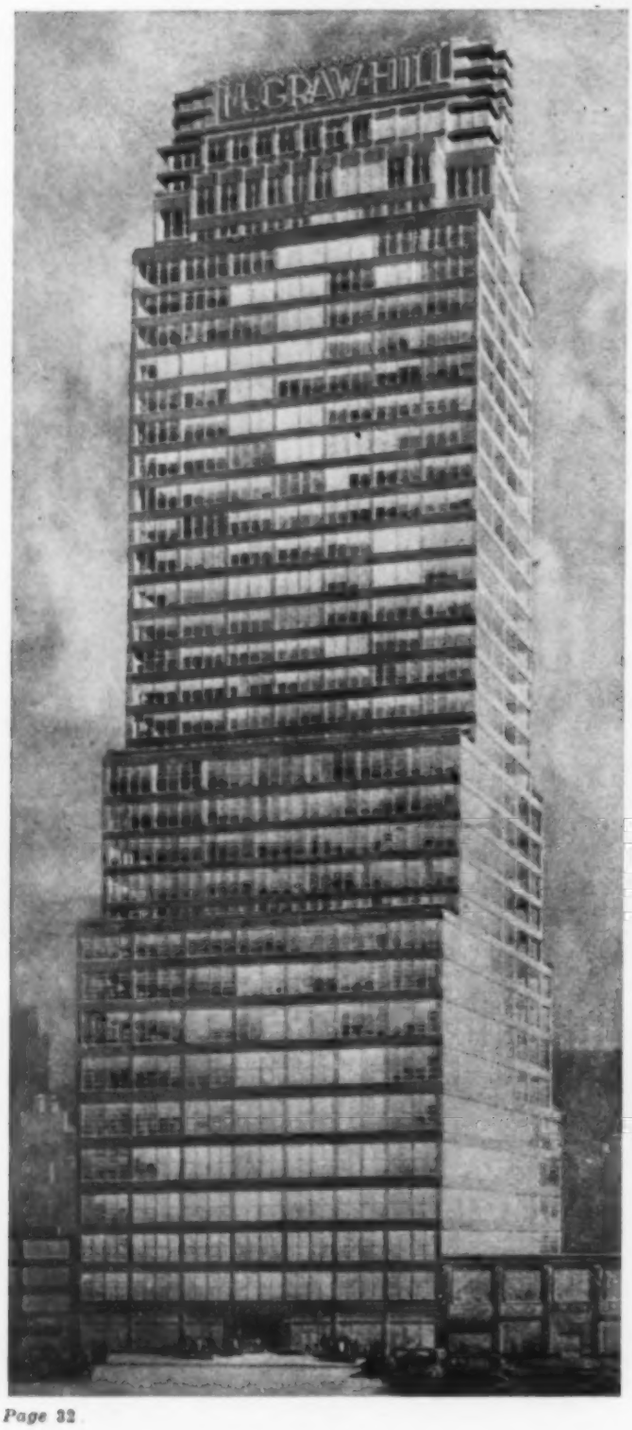
On the 50-ft. boom of a Northwest dragline, a wooden frame was constructed to form a track for the cutter. The boom was the type that could be lengthened or shortened by 10-ft. boom sections. A wooden bucket with scarifier teeth and steel cutting knives operates on this wooden frame. The scarifier teeth remove the irregularities and the knives plane the surface down. The sections of the knife cutter project in steps and there is no tendency for the device to tear the bank down, the action being more like that of a plane. It was estimated by the contractor that 75 men would have been required to do the work as rapidly as the machine.

The boom is adjusted to give as much cut as the machine can handle and is lowered as the slope is reduced. A header of planks is placed at the foot of the slope against the tractor tread to keep the material from getting under the tracks and thus make moving difficult.

The grading work by Mr. Colley was handled as a subcontract from J. V. Galbraith, Petaluma, Calif., the general contractor.

This Month's
NEWS REEL

TO HOUSE "CONSTRUCTION METHODS" and the other engineering and industrial papers published by the McGraw-Hill Publishing Co. New McGraw-Hill building at 342 West 42nd St., New York City, is a 33-story skyscraper being built by Starrett Bros. & Eken, Inc., from plans by Raymond M. Hood, Godley & Fouilhoux, architects. With virtually the entire front of every floor taken up by windows, the spandrels stand out as horizontal stripes and a striking color effect is obtained by facing them with blue-green glazed tile.



WATERWORKS MEMORIAL TO ALLEN HAZEN. Des Moines Water Works has named its new 2,000-gal. water tower for the consulting engineer, senior member of the firm of Hazen & Everett, who designed it shortly before his death last year. The steel tank support consists of fifteen concrete columns, outer cylinder 18 in. thick and 50 ft. in diameter, inner cylinder and circular reinforced concrete girder and beams. Water enters the tank through a 36-in. steel riser. Steel tank will be painted to harmonize with the concrete superstructure.—*Photo from* CHARLES S. DENMAN, *general manager, Des Moines (Ia.), Water Works.*

TEMPLE OF LIGHT *(above).* Unusual nine-sided structure topped by 75-ft. diameter hemispherical dome of glass in metal framework, to be finished with a highly ornamental surface material, is being built for the Baha'i Movement at Wilmette, Ill., by George A. Fuller Co., under engineering supervision of The Research Service, Washington, D. C. Superstructure is supported on circular platform 202 ft. in diameter, rising by 18 concentric steps to main floor, 153 ft. in diameter.—*Photo from* A. B. McDANIEL, *secretary, The Research Service, Inc., Washington, D. C.*

TO INCREASE TRAFFIC CAPACITY *(below)* of Queensboro bridge over East River, New York City, Department of Plant and Structures has built a three-lane upper-deck roadway, above level of existing roadway. New floor is supported by welded steel plates with troughed runways as accident prevention feature to keep vehicles in line. Contractors, Terry & Tench Co.

©Pictorial

©Keystone

INSPECT ARLINGTON BRIDGE. President Hoover, accompanied by Vice-President Curtis and Col. U. S. Grant, 3rd, Corps of Engineers, U. S. Army, in charge of construction, crosses new structure over Potomac River at Washington, D. C., leading to Lincoln Memorial. Length of multiple concrete arch crossing, with bascule span, is 2,108 ft.

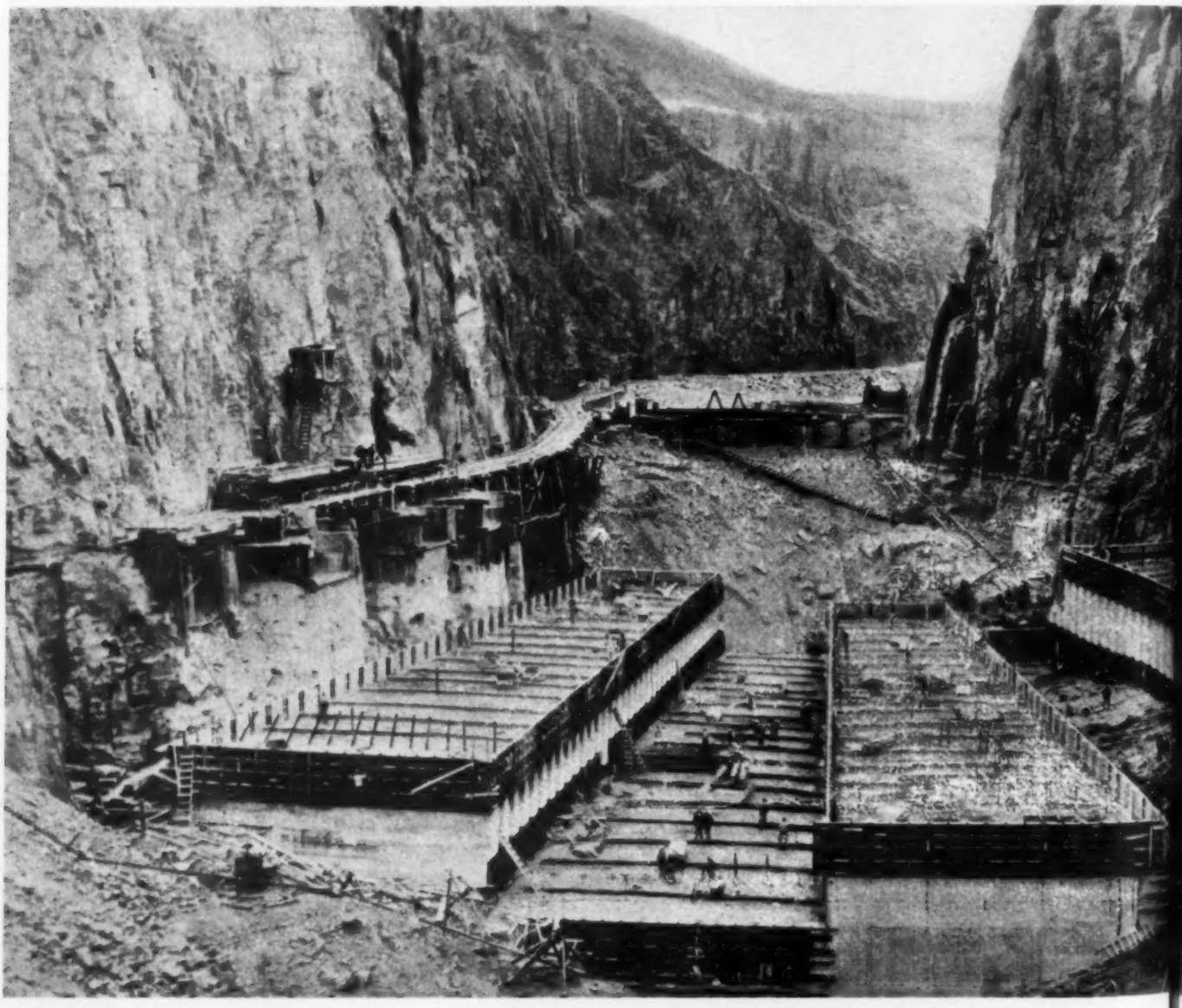
WORLD'S LARGEST POWER PLANT *(below)*. Constructing dam across Dnieper River, in Russia, as part of Soviet $110,000,000 hydro-electric project to develop 558,000 kw. Col. Hugh Cooper, of New York, is acting as consulting engineer on the work for the U.S.S.R. During the working season of 1930, a total 500,000 cu.m. of concrete was placed in the structure by batteries of cranes and derricks.

©Pictorial

CABLEWAY BUCKET *Concretes at Rate of* 1,000 CU. YD.

AN 8-cu.yd. bucket moving across the Owyhee dam site on the end of a 400-ft. vertical cable is depositing 1,000 cu.yd. of concrete per shift in the 530 ft. high arched gravity dam being built in Oregon by the General Construction Co., Seattle, for the U. S. Bureau of Reclamation to irrigate 125,000 acres of land. In addition to its height, the structure is of particular interest because of the faulted foundation which required special treatment, and the method used to deposit concrete. By using an electrically operated cableway, described in *Construction Methods*, November, 1930, p. 44, the usual chutes, towers and maze of guy wires are eliminated. The simplicity of the concreting operations, involving placement of 540,000 cu.yd. is illustrated herewith.

Foundation Treatment—The narrow gorge cut through the site by the Owyhee River is traversed by a fault. Borings indicated that this disturbance continued down through 85 ft. of shattered rhyolite, then diminished in a 22-ft. stratum of agglomerate and stopped in the more elastic underlying tuff formation. Excavation in this fault zone had been extended to a depth of 50 ft. when it became desirable to support the walls of the trench before going deeper. The trench was filled with concrete, leaving five openings as shafts through which excavation was continued 190 ft. below streambed. The cavity was then filled with concrete.



CONCRETE IS PLACED BY CABLEWAY BUCKET in 4-ft. lifts between radial upstream and downstream ends. Control cab for operating 8-yd. cableway

joints
bucket

Owyhee Dam PER SHIFT

Gravel Plant—Aggregate is a natural gravel obtained about 25 miles from the site. The gravel deposit was made the terminal of the construction railroad which connects with the Union Pacific system. Stripping and loading of the gravel is done with a 3-yd. Marion dragline which loads directly into 35-cu.yd. gondola cars. Trains are hauled by an 80-ton steam locomotive.

Arriving at the site, the cars are dumped into a hopper of one-car capacity and elevated by a 36-in. belt conveyor (300 ft. per minute speed) to a scalping screen where cobbles of more than 8-in. size are removed and crushed. The natural grading of the gravel is so close to a maximum 8-in. size that the crusher runs only about 1 hr. per shift.

From the scalping screen the material is elevated on a 30-in. belt with a 16-deg. slope (300 ft. per minute speed) to double revolving screens made by the Balzar Machine Works, Portland, Ore. Manganese sorting screens with round holes divide the aggregate into sand up to $\frac{1}{4}$ in. and coarse aggregate of four sizes: $\frac{1}{4}$ to $\frac{7}{8}$ in.; $\frac{7}{8}$ to $1\frac{3}{4}$ in.; $1\frac{3}{4}$ to 3 in.; and 3 to 8 in. The sand is run through a Bodinson sand washer. The graded aggregate is distributed by belt conveyors to stock piles below the screening plant. These piles are proportioned in size according to the estimated grading of the natural material and are designed to provide live storage of aggregate for 3,000 cu.yd. of concrete.

Gates in a tunnel under the stock piles load a horizontal 30-in. belt which discharges on to another 30-in. belt on a 14-deg. slope with a 400-ft.-per-minute speed to bins over the mixing plant. The plant bins are designed to provide live storage for producing 400 cu.yd. of concrete.

Concrete Mixing Plant—Cement is brought to the site in bulk and can be delivered on the job from the mill within 24 hours from the time of order.

OWYHEE DAM SITE, showing cableway, outlet of water diversion tunnel and railway for concrete delivery.

joints 50 and 30 ft. apart, respectively, at bucket hangs on canyon wall at left.

Cars are unloaded in 2 hours by two men with power scrapers. By bucket elevator the cement is lifted to the cement bins whence it is taken by screw conveyor to the weigher.

Two complete weighing units proportion the batches for the two 4-yd. mixers made by Norris K. Davis, San Francisco. Each mixer is powered by a 100-hp. motor and has a tilting angle of 57 deg., permitting discharge in less than 10 sec. The mixing periods are 1½ min.

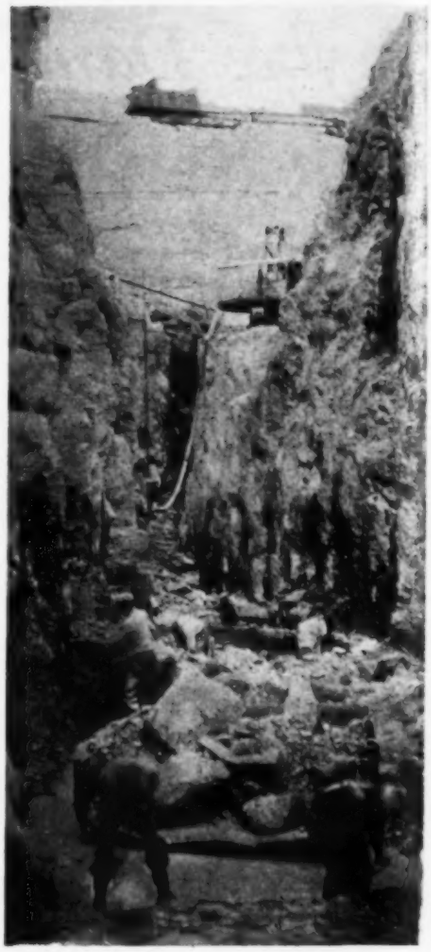
The aggregate is weighed by accumulation and the cement is weighed separately on a sensitive scale registering to 2 lb. Water is measured directly by meter to permit flexible control of the mix. The entire screening and mixing plant was designed to produce 1,000 cu.yd. of concrete per shift over sustained periods.

The entire screening and mixing plant crew, under the direction of a foreman, consists of the following: Two mixer men, one cleanup man at mixing plant, one top man on bins, one man in tunnel under aggregate storage, two unloading cement, one at screening plant, and two spotting and unloading gravel cars. Timken bearings are used exclusively throughout the gravel plant and all important bearings are of the self-aligning type to permit slight settlement in the structure. The power requirements for the entire plant amount to 500 hp.

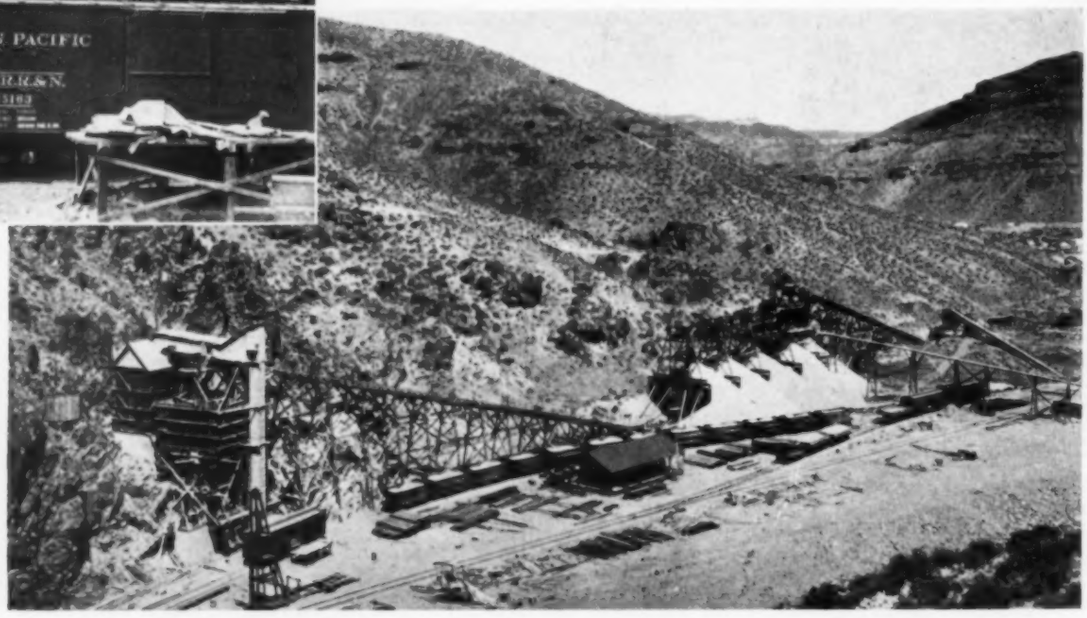
The contractor is not paid for aggregate brought to the site and not used. Thus far the material from the pit has been used completely without overrun in any particular size.

Two-Hopper Car—The batches of the two mixers are dumped simultaneously into a two-hopper, 8-yd. car built to fit the spacing of the mixer set-up. The hoppers have no doors and are emptied by tilting with oil-operated hydraulic hoists. Elimination of doors in the car design prevents leakage of grout. The concrete car is hauled about ¼ mile by Plymouth gasoline locomotive along the wall of the canyon on a timber trestle to a point where it discharges into the 8-yd. bucket for placement in the structure.

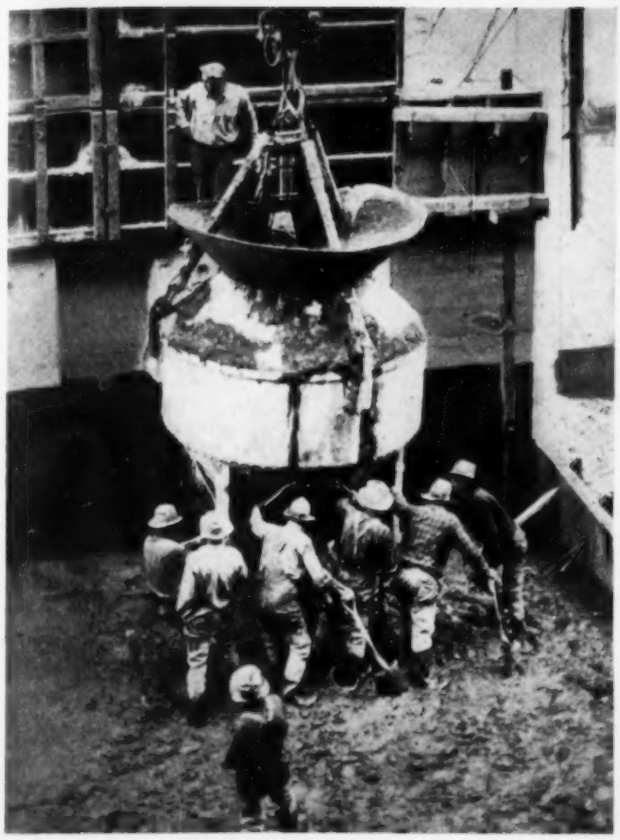
Concrete Placing—The loaded bucket weighs about 18 tons and is moved to position by the overhead cableway spanning the canyon. The operator, located in a booth suspended by cable on the canyon wall with full view of the concreting operations, maneuvers the bucket into position by means of an elaborate system of remote control to the motors at the cableway head tower. Spotting of the 18-ton load suspended from a 400-ft. vertical cable over the point of pour, particularly near the corners of the form and around the grouting pipes, involves considerable skill. Some operators acquire remark-



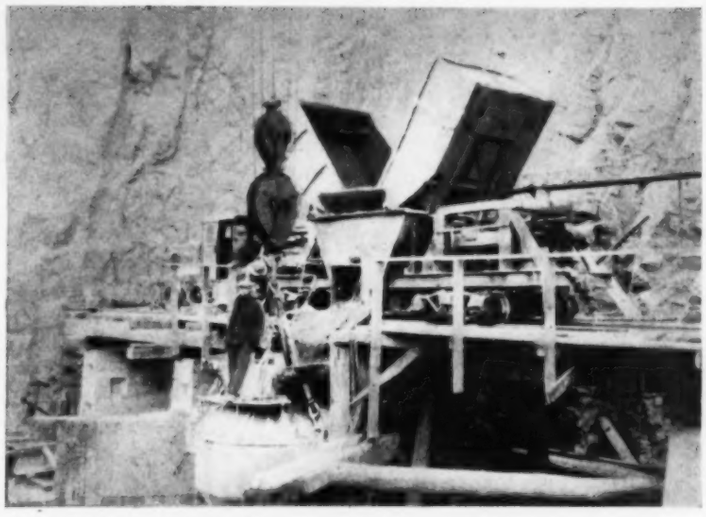
REMOVING MATERIAL from the fault zone in the foundation of the dam prior to filling with concrete.



SCREENING AND MIXING PLANT, using bulk cement, produces 1,000 cu.yd. of concrete per 8-hour shift. Gravel aggregate is handled by belt conveyors.

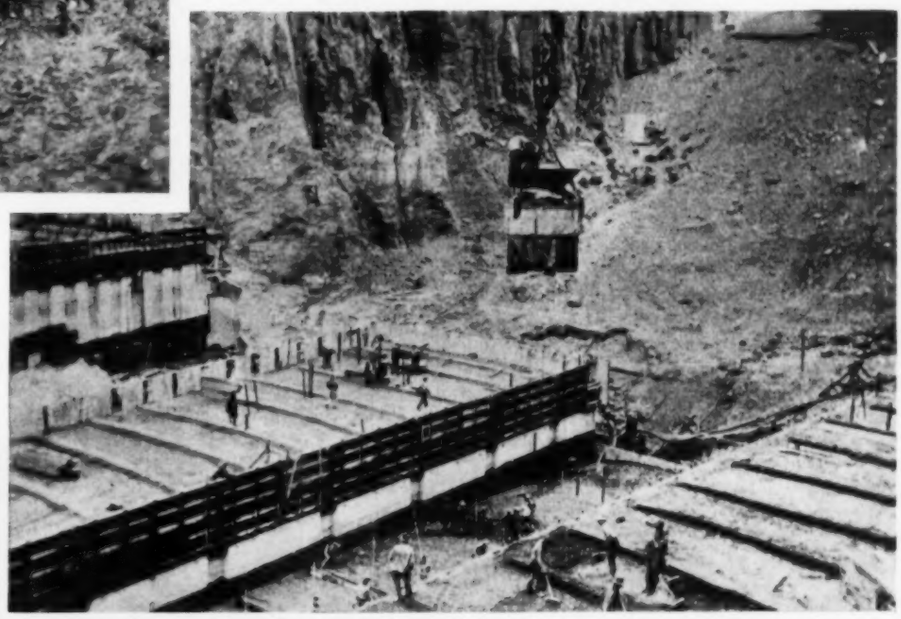


CABLEWAY BUCKET, carrying 8 yd. of concrete, is operated by worker who rides on it.

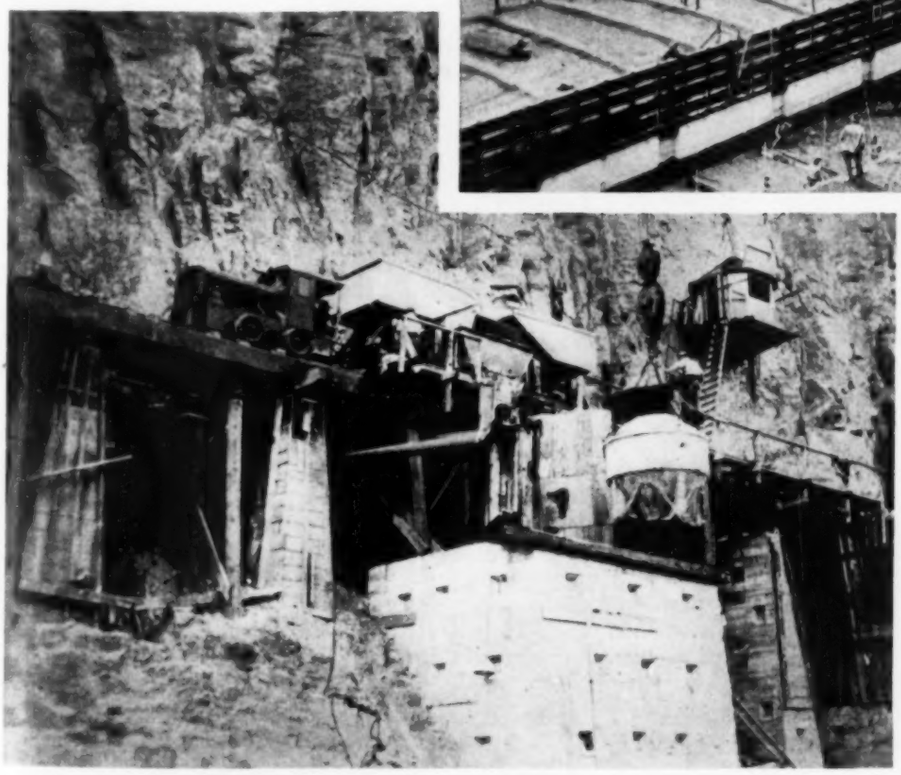


DUAL HOPPER CARS, each holding 4 yd., dump concrete into 8-yd. cableway bucket. Haulage is by gasoline locomotive on track along side of gorge.

able proficiency in manipulating the controls to gage for sway, sag in the cableway and the indirect braking effects of the load. In the lower sec-



CONSTRUCTION JOINT between radial blocks of concrete forming dam. Bucket, with operator on it, is descending to deposit 8-yd. load of concrete.



FILLING BUCKET from hopper cars hauled from mixing plant by gasoline locomotive.

tions of the dam, where pouring operations are below the elevation of the track from the concrete plant, round trips of the bucket are made in from 2½ to 3 min., except when depositing in corners. Enough pouring has been done to indicate that the proposed rate of 1,000 cu.yd. in 8 hours can be maintained.

The original bucket design used a horizontal slide gate, lever-operated by men of the concreting crew. This scheme did not prove satisfactory because of the number of men required to pull open the gate and the necessity of spotting and maintaining the bucket within reach. An improved discharge

arrangement consists of a double-leaf drop gate released by a man who rides the bucket. In addition to operating the discharge this rider assists in spotting the bucket by signals to the cableway operator and closes the bucket doors after dumping by a hand-operated cable reel. This work provides the most spectacular job in the concreting operations and the rider often has strenuous moments when the bucket bumps into position for a load or starts a swift swing across the canyon.

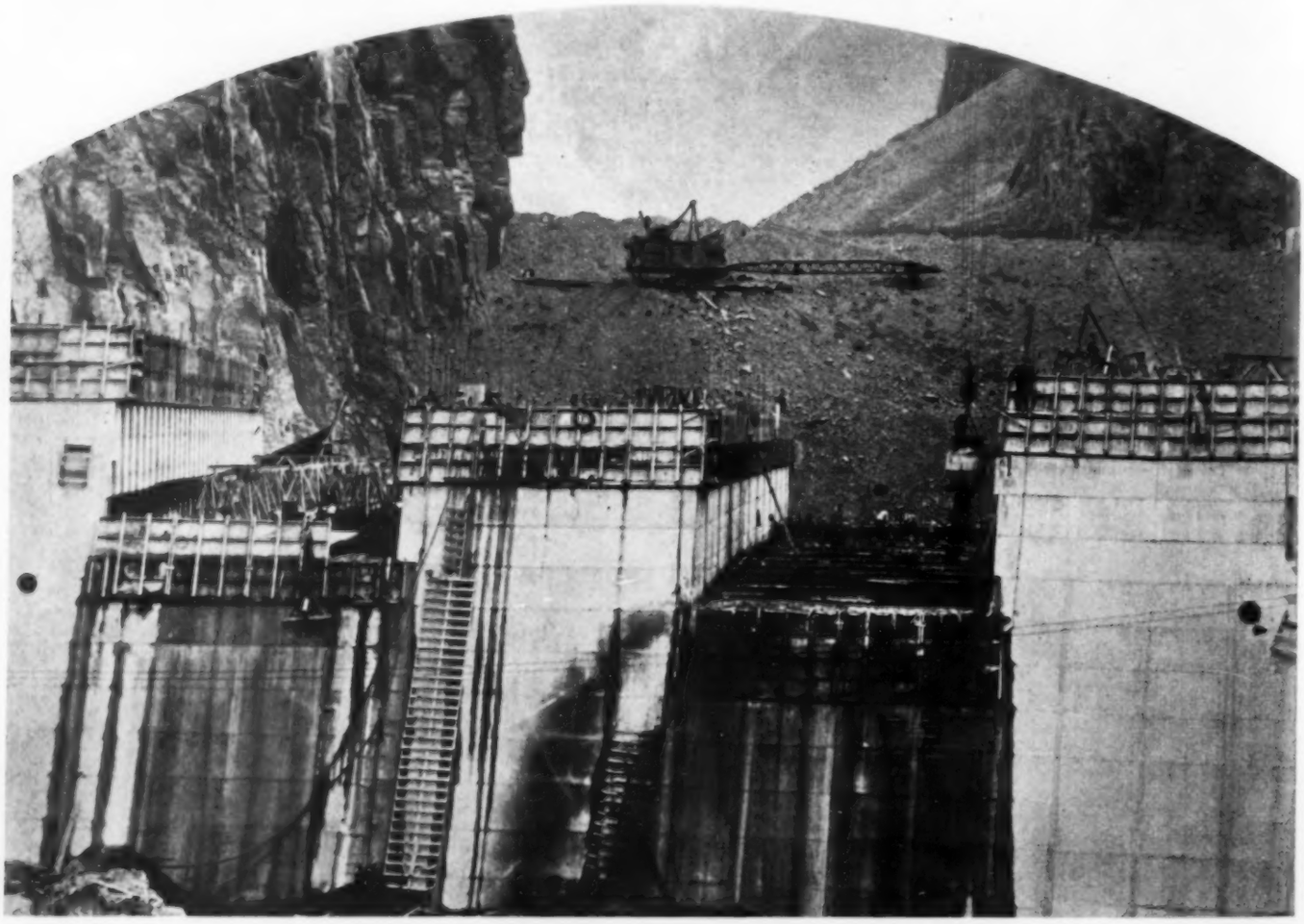
Pouring Procedure—Concrete pours are in 4-ft. lifts between radial construction joints varying from 50 ft. apart at the upstream face to about 30 ft. on the downstream near the base. A period of 72 hours is required before the following pour is permitted on the same section. Concrete is deposited in layers 1 ft. thick and the completion of the pour is finished by leaving the usual horizontal raised keys on 10-ft. centers across the pour. About 12 hours after completion of the pour, the surface is brushed and cleaned with a blast of compressed air. Then, just prior to the beginning of the next pour, the surface is again thoroughly washed with water and compressed air and a slush coat is applied to insure proper bond. Copper water stops are provided in each construction joint, 1 ft. back from both the upstream and downstream faces. The stop on the downstream face is provided primarily for the purpose of retaining the grout.

Grouting along the upstream face was provided for by a row of holes drilled in the bottom of the cutoff at 5-ft. intervals. The depths vary from 115 ft. along the base to 40 ft. near the top of the abutments. These holes are carried up as pipes in the concrete until a depth of at least 5-ft. is poured and set over the adjacent area before they are grouted under a 200-lb. pressure. About 10 ft. downstream from the grout holes a row of drain holes is provided at 5 ft. intervals. These are drilled into the foundation rock subsequent to the cutoff grouting through pipes carried up in the concrete. In addition twelve pipe connections to the foundation contact are being placed in various locations to provide for a study of uplift when the reservoir is put into service.

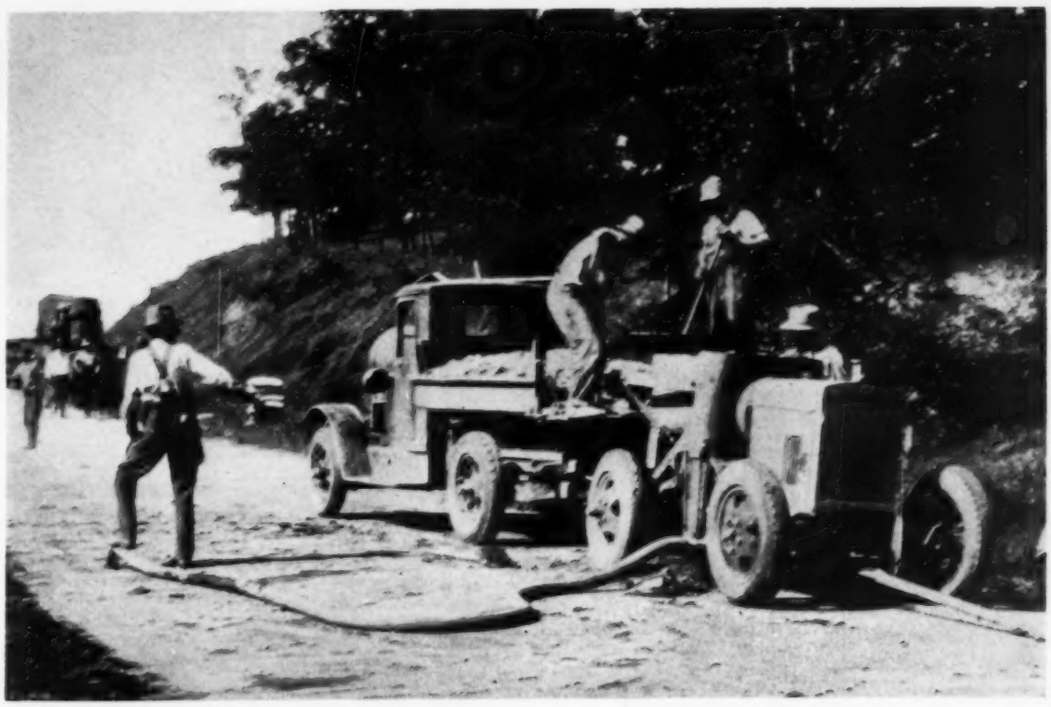
For grouting the construction joints a complete system of pipes is provided with outlets every 4 ft. vertically and horizontally on the face of the joint. Horizontal header pipes for the application of grout are provided every 100 ft. above the foundation. After sufficient time has elapsed following completion of the dam, these joints will be grouted under 100-lb. pressure in 100-ft. lifts beginning at the bottom.

Organization—The Owyhee dam is being built for the U. S. Bureau of Reclamation. The General Construction Co., Seattle, J. A. McEachern, president, and J. W. Lawlor, manager, have the contract for the dam and are represented by Ben Cook, superintendent, Charles Clapp, assistant superintendent and C. Wood, resident engineer.

Supervision of the work on the project is in charge of F. A. Banks, construction engineer, U. S. Bureau of Reclamation, with F. Schlapkohl, field engineer, and C. A. Betts, office engineer. R. F. Walter is chief engineer of the Bureau at Denver.



Forms on face of dam, with bucket delivering concrete into one of the radial blocks. Pouring is done in 4-ft. lifts.



MUD PUMP *(right)* forces thin, grout-like mixture of earth, cement and water through holes drilled in settled pavement, raising slab and filling all voids. Workmen on truck shovel topsoil material and cement into mixing chamber of machine.

MUD PUMP

Raises Settled Slab in Iowa

WITH the aid and encouragement of the Iowa State Highway Commission, John Poulter, one of its mechanics, has developed a machine which raises settled concrete slab by forcing a wet mixture of mud and cement through holes drilled in the slab. The machine consists of a small pug mill which feeds the mixture of mud, cement and water into a two-cylinder pump. A hose from the pump leads to the hole in the slab. Workmen on a truck backed up to the pump shovel earth and cement into the pug mill.

According to a report made by W. H. Root, maintenance engineer of the Iowa State Highway Commission, to the Highway Research Board, the first step in the raising operation is to drill 2½-in. holes through the pavement, 4 to 6 ft. apart. Black earth or other top soil is placed in the mixing chamber of the pump, and cement is added in the proportion of 1:20. Enough water is used to make a thin, grout-like mixture. Each hole first is pumped with mud to loosen the pavement slab; then additional mud is forced through the holes to bring the slab to grade. Usually it is necessary to cut a transverse expansion joint at one end of the settlement before raising, to allow for squeeze.

Up to October 1, 1930, six machines in Iowa had raised 46 settlements ranging up to 13 in. at a cost of 98.6c. per square yard. Although the settlements could have been leveled off with 334½ cu.yd. of bituminous material, the pump injected 705½ cu.yd. of mud filler. These figures seem to indicate that 371 yd., or 52 per cent, went to fill voids existing underneath the settled slab.

Cost of leveling the settlements with bituminous material, a temporary measure, would have been 85c. per square yard; cost of jacking up the slab and packing the voids with sand would have been $1.75 per square yard. The mud pump raised the slab cheaply and cured the trouble at its source by filling the voids.

The National Equipment Corporation, Milwaukee, has obtained the patent rights to the mud pump and is manufacturing the machine for market.

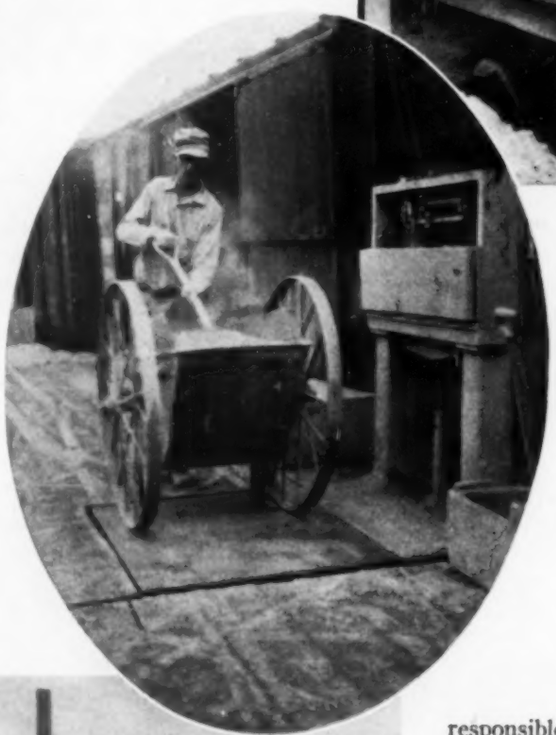
TWO-CYLINDER PUMP, mounted at center of chassis, works on churn-drill principle, taking material from pug-mill mixer at rear and forcing it through hose connection to hole in settled slab.

BULK CEMENT
on Iowa Paving Job

HAND CART *(right)* carries bulk cement from box car and dumps it on to batched aggregates in body of truck under platform. Canvas discharge hood attached to opening keeps cement from blowing away.

WITH only one exception, every contractor engaged in the construction of almost 1,800 miles of concrete roads in Iowa in the last two years has used cement in bulk. The methods of handling the bulk cement are extremely simple in comparison with the refinements and precautions required and practiced in many other states. Uniformly good quality of the concrete obtained justifies the Iowa State Highway Commission and the Bureau of Public Roads in permitting the direct and simple practices of the paving contractors.

The John P. Abramson Construction Co., of Des Moines, Iowa, employed typical methods of handling bulk cement on its 11½-mile contract for 10-7-10-in. slab, 18 ft. wide, on state route 13 between Marion and Central City. Approximately 4½ miles of relocation on the contract was chiefly responsible for the 171,000 yd. of excavation. A railroad line intersected the job near one end, and a second railroad siding was available a short distance from the other extremity.

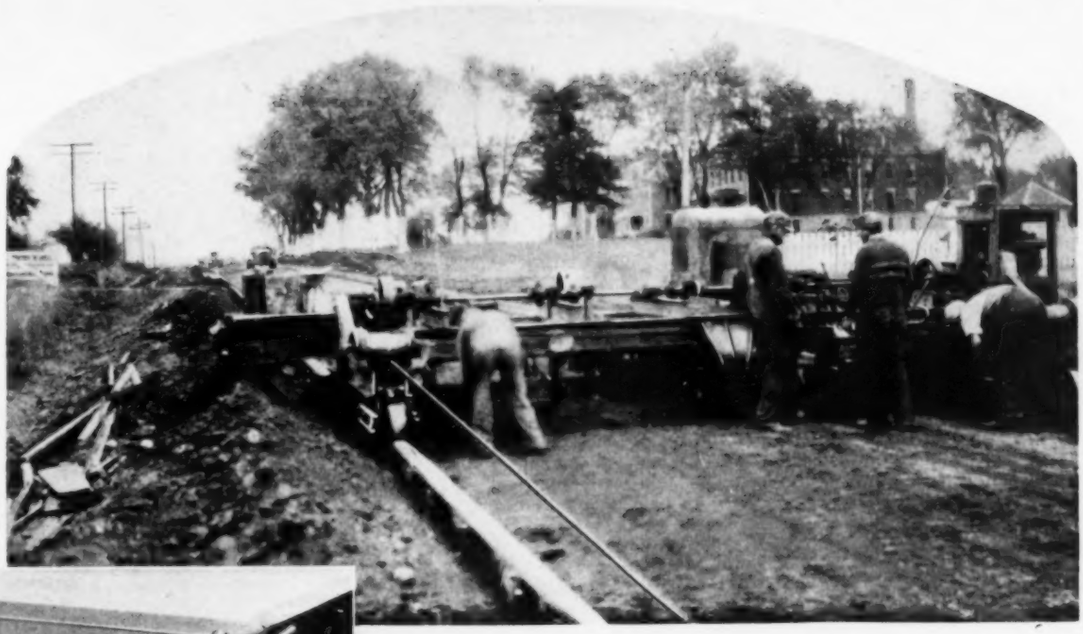


BEAM SCALE *(left)* is set to indicate correct weight of cement and cart. Handler adds or removes cement with shovel until beam balances.

OPENING FOR CEMENT *(below)* and attached cart tracks *(indicated by arrows)* are counterweighted to rise when no cart is on them, lifting canvas discharge hood so that truck can back under platform without touching hood. Weight of cart on tracks pushes hood down in contact with sand and gravel on truck.

Cement Handling—At both locations of the material-handling plant, the contractor unloaded bulk cement out of box cars into hand carts, weighed the cement in the carts, and dumped it on top of aggregates already loaded in the trucks. Inside the car, the cement-handler shoveled the cement into his cart; experience quickly taught him to estimate closely the volume required for a batch.

A cement-handling crew of four men was sufficient to supply a paver laying about 100 lin.ft. of slab per hour for 11½ hours a day. In hot weather, the force was increased to six men. Two cars usually were unloaded at a



MECHANICAL FINE-GRADE FINISHER *(right)* travels on cap rails laid on road forms. Machine propels itself by winches on both sides. Moving blades cut fine grade to true crown, and belt conveyor delivers earth outside forms to either side.

FLOAT *(left)* for lip curb shapes concrete cast integrally with slab. Curb concrete is placed against 3-in. rail on top of form as soon as slab finishing is completed by double belting.

time, half the crew operating out of each car. The men ran the carts out of the cars on to a platform on the same level with the car floor.

The cart was stopped on the platform of a Howe beam scale installed flush with the floor, and the cement handler added or removed cement from the cart until the beam balanced. A box alongside the scale contained cement for this adjustment, which was made very quickly with a shovel, as the error never amounted to more than a few pounds.

From the scale, the carts moved on to two tracks over the opening through which cement was dumped into the body of the truck below. Attached to the opening was a heavy canvas hood to prevent escape of cement dust. The opening and cart tracks were counterweighted to rise when there was no cart on the tracks. In raised position, the canvas hood did not touch the body of the truck as the vehicle backed under the platform. When a loaded cart on the tracks pushed them down, the hood was in contact with the batched aggregate. This contact prevented cement dust from blowing away when the cart was dumped.

After the truck had pulled out from under the platform, it stopped to allow a workman to shovel some of the aggregate over the cement. This aggregate was the only cover used to protect the cement on hauls ranging up to 6 miles in length, except in wet weather, when a tarpaulin was spread over the top.

J. E. ABRAHAMSON *(left)*, in charge of concrete paving; JOHN P. ABRAMSON; and H. M. WILLIAMS, in charge of grading.

Aggregates were handled out of gondola cars by a Koehring crane with a 40-ft. boom, swinging a Blaw-Knox 1-yd. clamshell bucket. The crane maintained stock piles and fed the 40-yd. Blaw-Knox bins which loaded the trucks.

Year's Record—The Marion-Central City contract was the second performed by the John P. Abramson Construction Co. during 1930. Total concrete slab construction for the year amounted to 25½ miles and required 330,000 yd. of rough grading.

Rough Grading—Operations of the rough-grading crew were directed by

AFTER LEAVING CEMENT PLATFORM, batch truck stops to let workman cover cement with sand and gravel. Aggregate is only cover used on cement, except in wet weather, when tarpaulin is spread over top of batch.

H. M. Williams. To move the 171,000 yd. of excavation on the Marion-Central City contract, Mr. Williams had one P&H 1-yd. dragline, one Koehring 1-yd. dragline, five 60-hp. Caterpillar tractors, one elevating grader (power-driven by Caterpillar 60-hp. tractor), three 8-yd. LaPlant-Choate wagons, one Adams 12-ft. blade grader, one J. I. Case 10-ton steam roller, and five International 2-ton dump trucks. For shoulder finishing, also under his direction, he had two 60-hp. Caterpillar tractors, two 10-ft. Adams blade graders, two 6-ft. Adams blade graders (Fordson-drawn), and two Iron Mules.

Fine Grading—Fine-grading and paving operations were superintended by J. E. Abrahamson. The principal machine used in getting the subgrade ready for paving was a French Nu-Method finish grader. Other fine-grade equipment included one 30-hp. Caterpillar tractor, one Adams 1-yd. rotating fresno scraper, one Carr scarifier, one Carr form grader, one Russell 8-ft. blade grader, one Austin 3-ton roller, and two Austin horse-drawn fresnos.

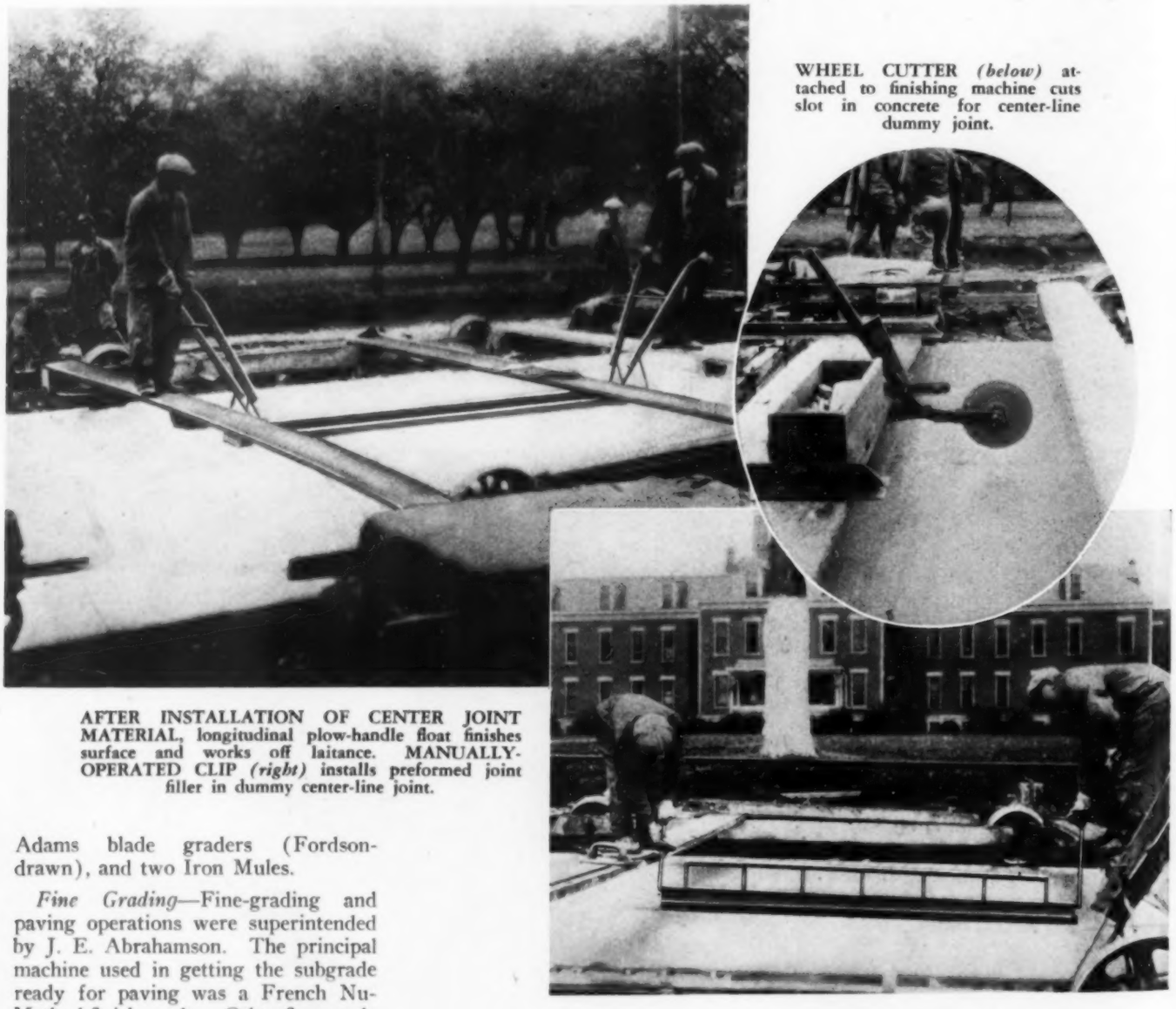
With the Nu-Method finish grader, a crew of five men and the operator prepared 1,200 to 1,400 ft. of subgrade at night, ready for the day's run. As the grading machine operated on the road forms, the contractor aided his night crew by setting the forms in the afternoon. The job was equipped with 5,600 lin.ft. of Blaw-Knox forms to allow setting far in advance of the mixer. Cap rails 20 ft. long were used under the wheels of the finish grader to distribute its weight over two form lengths.

Paving Program—The schedule of paving operations was planned to prepare for wet weather late in the fall. Starting paving on the Central City end, Aug. 8, the contractor paved 7 miles from this set-up and, then, moved the plant to the railroad siding at the Marion end. The 2½ miles nearest Madison was on new location. This portion was paved first to assure hard surface for a short haul to the mixer in paving the last 1½ mile gap, no matter what the weather.

The working day was from 6 a.m. to 6 p.m., with ½ hour off at noon. An average progress of 1,050 ft. in 11½ hours was maintained.

Paving and Finishing—The paving and finishing operations were performed by the usual means. On this job, the contractor showed the common Iowa preference for a wheel cutter, attached to the finishing machine, to make the slot for the centerline contraction joint. A photograph illustrates the device used in installing the center joint material in strips 8 ft. long by 2½ in. deep.

Personnel—The road was built under the direction of the Iowa State Highway Commission, Fred R. White, chief engineer; F. H. Mann, construction engineer; and W. P. Lindauer, resident engineer. John P. Abramson maintained general supervision of construction operations, with H. M. Williams in charge of grading and J. E. Abrahamson in charge of concrete paving.



WHEEL CUTTER *(below)* attached to finishing machine cuts slot in concrete for center-line dummy joint.

AFTER INSTALLATION OF CENTER JOINT MATERIAL, longitudinal plow-handle float finishes surface and works off laitance. MANUALLY-OPERATED CLIP *(right)* installs preformed joint filler in dummy center-line joint.

A PLATFORM FOR AMERICAN BUSINESS

A Statement of Underlying Principles with some Practical Suggestions to Guide in Planning Future Progress

PRESENTED BY McGRAW-HILL PUBLISHING COMPANY, INC.

THE BUSINESS DEPRESSION of 1930 was no mere passing episode. The appalling loss and suffering entailed have struck home the more forcibly because they followed a period of unparalleled prosperity in a country that still possesses vast wealth and abundant resources. As a result of its duration and severity, the depression has shocked business, governmental and social agencies into commendable activity for the relief of human suffering and distress.

But, what is more significant for the future, it has also aroused an insistent demand for a searching analysis of the weak spots of the business and economic systems under which such a calamity was possible. It is an encouraging sign that men are beginning to question whether these recurring periods of boom and depression are not preventable; whether it is possible under better management to insure greater security to all classes of people who are willing to work; whether their faith in American achievement and standards of living can be preserved.

Evidence is multiplying that these questions can be answered in the affirmative; that this challenge to the American business and economic systems can be met in such a manner as to justify our confidence in them. Instead of regarding business depression as a storm to be weathered or a condition that must be endured and allowed to "work itself out," thinking men are beginning to look upon it as an economic plague that can be averted and wiped out by preventive measures. Sentiment is stirring in favor of doing something about it, heeding the warning of our latest experience and preparing actively to meet the issue it raises.

It is the responsibility of the business press to crystallize constructive policies and to encourage progressive leadership. Therefore, the McGraw-Hill Publishing Company desires to do its part in helping to clarify the situation and to stimulate thought and action. It believes in the philosophy of individual enterprise and cooperative effort on which American achievement has been based. And it has confidence in the ability of American management to recognize and adopt sound economic principles as a basis for constructive business policies. But it is equally certain that only by conscientious effort on the part of each business unit, large or small, can American business as a whole return to normal and pursue a steady course.

PLANNING IS ESSENTIAL for uninterrupted progress. To assist in such a program the McGraw-Hill Publishing Company offers through its publications the following principles and practical suggestions as a guide in formulating individual plans. They are not presented as a ready-made formula for success, but as a foundation on which business can be built with some protection from the shocks and dislocations that have plagued it.

money may be placed in capital expenditures—modernization, research for development, new patents, etc.

B. Each business enterprise has a responsibility to aid in the development of regional and national resources.

Development of National Resources

(1) Encourage and cooperate in the coordination and promotion of the economic area in which you are located through constructive programs for the improvement of agricultural, commercial, industrial and community development. (*Example*—New England Council.)

(2) Assist in the work of national associations devoted to the improvement of business ethics, the promotion of higher standards in the commercial, industrial, financial and political administration of the country, and the simplification of the laws governing business. (*Example*—Chamber of Commerce of the United States.)

IV—Maintenance of World Business

Probably the greatest potential market for present and future American products lies in that foreign field represented by the present difference between the living standards of the American public and those of a billion and a half people in many other countries. Any slight increase in the living standards of these vast populations will bring immediate benefits to American manufacturers, as the largest producers of those commodities contributing to labor saving and luxury.

A. Support cooperative studies and formulation of world policies among business interests through international business organizations on such subjects as—

International Business Cooperation

(1) World tariffs.

(2) Trade discriminations.

(3) International movement of capital.

(4) War debts and reparations.

B. Promote uniformity in foreign trade practice by encouraging coordination among organized industries.

money may be placed in capital expenditures—modernization, research for development, new patents, etc.

C. Carry this long term planning into sales control, involving distribution methods, sales forecasting and pricing.

Sales Control

(1) Revise present methods of distribution and service to conform to the best interests of the customer. (*Example*—establishment of retail stores by mail order houses.)

(2) Prepare sales forecasts by products and by markets with regard to competition. (Leading institutions have found that modern sales forecasting can be correct within 2 to 3% for a year ahead and within 5 to 15% for three years ahead.)

(3) Know costs and stop selling at a loss. Maintain firm minimum prices based on production costs. (Business history shows a high degree of prosperity among those companies, large or small, which have had the courage to stand on a minimum price that insured a profit.)

(4) Plan sales organization, sales program and advertising on at least a three-year basis.

D. Plan for uniform production as far ahead as possible on the basis of sales requirements already determined.

Production Modernization

(1) Modernize and replace every existing production facility, including plants, factory and office equipment and methods where it is possible to effect cost reduction and greater production flexibility. (Stores, banks, and offices have a production problem no less than factories.)

(2) Do not expand production facilities in the mere hope for lower costs through larger production, but only where the long term forecast shows the necessity for additional facilities.

(3) Base purchase of materials, supplies and equipment upon the marketing and production program for the three-year period and make purchases as far ahead as practicable.

E. Stabilize financing. Working capital requirements for labor and material, and business capital requirements for development and expansion, can be determined with reasonable accuracy for a period ahead by long term planning.

Financial Policies

(1) Do not depend permanently upon bank credit for purposes other than short-term loans for current working capital. (In the interim partial payment financing of equipment, etc., is widely accepted as sound business practice.)

(2) Raise needed fixed capital requirements by bond or stock issues whenever reasonably advantageous.

(3) Invest surplus in short-term commercial paper or good bonds rather than employing it in call money or for purely speculative purposes.

Many of America's soundest corporations have adopted these financial policies.

GENERAL OBJECTIVES

The following general objectives are fundamental in planning sound business developments:

1. Maintenance of Established Standards of Living

The belief that there is danger of a general overproduction of wealth, that technical development necessarily involves unemployment, or that standards of living cannot be indefinitely increased is an economic fallacy. American business should not yield to it in any of the policies it pursues. Rather it must protect and preserve our economic standards and social traditions by maintaining high purchasing power and regularity of employment and dividend disbursements, based on more stabilized methods of management and financing made possible by long-term planning.

RECOMMENDATION: Conserve and add to the gains achieved in the past ten years through technical advance, improved forms of industrial organization and methods of management, and new devices for financing industrial and market expansion. Increase efficiency in the economic production and distribution of goods and services so as to facilitate their widest possible consumption and thereby raise the standard of living of the American people.

2. Stabilization of Future Business Growth

So long as there are wide fluctuations in business and in price levels, the gains to some groups are cancelled by losses to others and there is no net gain to the country as a whole. The interests of the speculative and creditor groups should be subordinated to the interests of those concerned with the production and distribution of goods and services. The latter should have a larger measure of leadership in business policy to insure sound and lasting prosperity.

This leadership can be exercised only by a more deliberate process of long term planning and organization for the direction and development of business operations. Such effort involves market analysis, sales control, product development, modernization of factory and office methods, foresight in purchasing, long-term financing of fixed capital requirements and a stimulated program of capital investment in 1931 for the restoration of business volume. All this must be supported by broader policies of coordination within the industry or trade, cooperation with labor and participation in the organized development of regional and national resources.

RECOMMENDATION: Direct individual and organized effort to check excessive and unbalanced industrial and financial expansion, and prevent wide changes in price levels. This will remove the incentive to speculative gain, avoid conflict of creditor and debtor groups, and promote confidence in long-term investment and borrowing. It will also encourage productive and commercial enterprise, maintain a steady increase in consumer purchasing power and stabilize business progress.

3. Promotion of International Business Cooperation

The world is economically interdependent. Though the United States is the dominant factor in world prosperity, she cannot maintain or increase her own prosperity indefinitely without sharing it with the world, nor can her business system survive unless, by sharing its benefits, the other nations of the world can preserve their faith in it. This calls for a more active policy of international cooperation on the part of American business to assist in the gradual reduction or removal of unnecessary trade barriers that interfere with the natural exchange of goods and services between peoples, the development of a more stabilized international mechanism for the movement of capital and control of credit, and the revision of war debts and reparations.

RECOMMENDATION: Support individual or organized effort to promote cooperation among business and financial interests of the United States and other countries, in order to facilitate the normal international movement of goods, services and capital, and thereby enhance economic stability at home and elevate standards of living abroad.

4. Encouragement of Private Initiative and Responsibility vs. Extension of Governmental Activity

American business should encourage self-government. It has already shifted enough of its responsibility and thereby yielded enough of its initiative to government and must stand its ground against further extension of governmental action in matters in which it can assume responsibility itself.

The essential function of government is to keep clear the field of economic activity for private business initiative and to assure a basis of fair and equal competition in domestic and foreign trade. It should refrain from competing with any kind of business itself. It should facilitate and encourage the development of necessary controls upon business through organized self government. It should safeguard the economic stability of the country by maintaining stability in its own fiscal and international policies. It should reduce to the minimum the number of laws affecting business.

RECOMMENDATION: Oppose governmental regulation, control or expenditure which tends to limit or weaken private individual initiative or cooperative effort, or to diminish the responsibility of the individual business concern or organized industry, for the accomplishment of the objectives stated above.

RESPONSIBILITY FOR ACTION

This course of action for (1) the maintenance and elevation of American standards of living, (2) the stable development of American business, (3) the promotion of international cooperation and (4) the restriction of governmental encroachment upon private initiative and cooperative effort cannot be carried out without the earnest participation of individuals and organized groups representing all types of business and industrial activity.

Upon the following major groups the main burden of responsibility rests:

A. Industrial and Business Management: A few thousand business concerns in this country employ the bulk of the wage-earners, originate most of the consumer income, and produce the chief part of the goods and services that determine the standard of living. Upon the management of these concerns therefore rests the main responsibility for action that will:

(1) Formulate long-term plans for research, production, distribution, purchasing and financing.

(2) Support cooperative effort through industrial, trade and commercial organizations.

(3) Maintain wage scales that permit a high standard of living and purchasing power.

(4) Maintain and equalize employment by adjustment of working hours.

(5) Establish a reserve to protect the security of employment in times of reduced production.

(6) Establish and maintain stable prices.

(7) Maintain reasonable, stable dividends, conserving surplus accumulated in periods of prosperity for such use in slack times.

B. Industrial, Trade and Commercial Organizations: The power of business units is multiplied and their leadership is strengthened by vigorous, intelligent and far-sighted trade organizations. Through them it is possible to carry the foregoing principles into action on an industry-wide basis, which is necessary to their realization in each industry as a whole and to the even balance among all industries requisite to stable progress. They should cooperate in:

(1) Collection of data on costs, stocks, production, potential productive capacity and market conditions.

(2) Interchange of credit information.

(3) Development of codes of practice.

(4) Establishment of standards of employment salaries and wages within the industry.

(5) Development of opportunities for stabilizing business.

(6) Study of market development.

(7) Economic development and use of natural resources.

A CHECK SHEET of Practical Suggestions for Planning a Company Program

I—Long Term Planning of Business Operations

A. Definitely abandon the yearly period as the basis for business operations, except in accounting matters.

(1) Project business policies and planning, wherever possible, upon a three-year period or longer as a unit.

B. Initiate research from the customer's standpoint to determine:

Analyzing the Business

(1) To what extent established lines should be replaced, improved or simplified.

(2) What additional markets can profitably be penetrated with these lines.

(3) What new products can logically be added for present and new markets.

dividend disbursements. (*Example*—U. S. Steel Corp. policy.)

II—Coordination with Industry or Trade

A. The success of long term planning for an individual business is multiplied and secured when similar policies are established throughout the industry.

(1) Aid in the establishment and share in the active development of an industry, trade or commercial organization —

(a) to collect data on costs, stocks, production, potential productive capacity and market conditions.

(b) to interchange credit information.

(c) to develop codes of practice.

(d) to take full advantage of legal trade cooperation.

(2) Cooperate to establish standards of employment, salaries and wages within your industry. (Labor is particularly susceptible to advantages offered by a business where long-term planning gives stable employment.)

III—Promotion of National Prosperity

A. The net profits of a modern business depend not only on its own activities but on sustained business stability throughout the country. There is a vital responsibility upon each business enterprise to do its share to provide national stability of purchasing power through —

Stabilization of National Purchasing Power

(1) A policy for employment.

(a) Establish a minimum payroll based on the planned program of production and sales and consider this minimum payroll as a fixed charge on the business. (*Example*—the Procter & Gamble plan.)

(b) Maintain a salary and wage scale that permits a high standard of living and thus of purchasing power.

(c) In slack periods, preserve the organization of trained personnel by reducing hours of work per man rather than reducing number of employees.

(d) Set up a reserve to protect the security of employment in times of reduced production.

(2) A policy for dividends.

(a) Resist the temptation to pay out excessive sums in dividends in boom times. Rather place excess earnings in reserve and do not hesitate to use this reserve in slack times to maintain national purchasing power through dividend disbursements. (*Example*—U. S. Steel Corp. policy.)

C. Banking and Financial Institutions: Next to the will and intelligence of individual and organized business, the most important factor in achieving the four objectives of this platform is the understanding and cooperation of the banking system in checking excessive inflation in times of prosperity and excessive deflation in times of depression. In the exercise of this function, business itself may well expect banking and financial institutions to:

(1) Require business management to think in terms of long-time planning where financial assistance is provided.

(2) Encourage corporations to accumulate substantial reserves in good times to be used in slack times for development and dividends.

(3) Discourage the extension of excessive credit in periods of unusual prosperity and in like measure facilitate legitimate credit in times of stringency.

(4) Assist in the promotion of mergers where real benefits can be obtained but oppose the merging of corporations for stock selling purposes.

(5) Lead in the development of international financial cooperation.

D. Labor: Stability of industrial and business operations requires a sympathy by American workers with the policies expressed in this platform, and a willingness to cooperate in making them effective. Responsibility rests upon labor as well as upon management if the worker is to enjoy the benefits of our business system. To this end labor should actively support these principles:

(1) That increased wages are dependent upon increased efficiencies in production and distribution.

(2) That business must be conducted profitably if labor is to enjoy higher standards of living.

(3) That employers operating on a program of long-time planning provide the maximum stability of employment.

(4) That labor should demand of their leaders an understanding of sound business principles.

(5) That the welfare of labor will best be served by recourse to arbitration and the avoidance of industrial strife.

(6) That the development of international trade is essential to domestic prosperity.

(7) That the extension of governmental activity hampers business in assuming its social responsibilities.

E. Government: The essential function of government is to keep clear the field of economic activity for private business initiative and to assure a basis of fair and equal competition. It can best promote sound economic development through these policies:

(1) Refrain from competing with any kind of business itself.

(2) Encourage the development of the necessary control of business through self-government rather than by legislation.

(3) Safeguard the economic stability of the country by maintaining stability in its own fiscal and international policies.

(4) Exercise the greatest economy in public expenditures.

(5) Reduce to a minimum the number of laws affecting business.

(6) Cooperate with foreign nations for the fullest development of international trade.

AND IN CONCLUSION

THESE RECOMMENDATIONS can have value only as they are applied in the planning of individual company operations and in the programs of those industrial, commercial, financial and governmental agencies that are responsible for the conduct of our economic affairs. But taken broadly they constitute a platform of economic principles and business policies upon which far sighted management may well make a stand.

New conditions of our modern industrial civilization have laid new social responsibilities upon those men who guide the destinies of business enterprise. The protection of the welfare of workers and their security of employment and the assurance of permanent income to investors have become basic factors in the attitude of public opinion towards industry. And public opinion in the end has the power to preserve or to curtail that freedom of initiative around which the whole philosophy of American life has been organized.

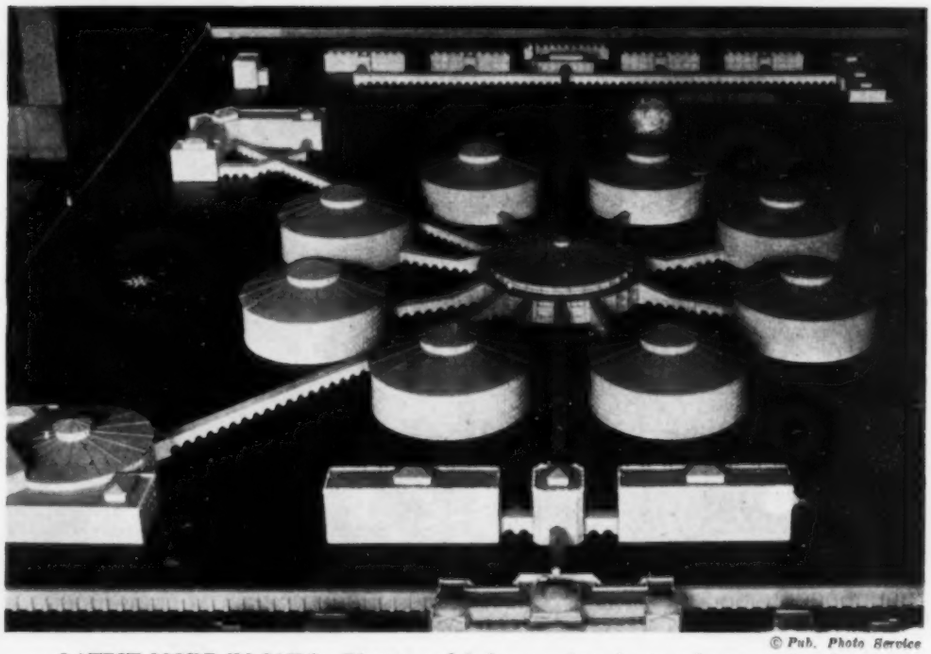
Business management must meet the call of these responsibilities, therefore, if the people of the world are to be lifted out of the present depression and given assurance of greater stability of earning power in the future. Business leadership itself must strengthen and secure the success of this system of private initiative and cooperative effort upon which the prosperity of this country has been founded and of which it stands today as practically the sole exponent.

This proposed platform is being presented to American business through McGraw-Hill publications reaching into nearly every major industry in the country. It will be developed and interpreted editorially as a guide to the formulation of individual plans and business policies

AS A FURTHER AID in that direction the reader will find within this supplement a check sheet of practical suggestions. Many of them are known to be practised by successful, well managed business concerns. It is believed that they will be of value and assistance to all American businessmen in planning for future progress and prosperity.

JOB ODDITIES

A Monthly Page of Unusual Features of Construction



© Pub. Photo Service

LATEST MODE IN JAILS. Plaster model shows unique layout of new penitentiary in Cuba, with circular buildings grouped around central structure. Like spokes of a wheel, covered passageways connect units.

TUNNEL FOR SADDLE HORSES. At altitude of 7,000 ft. in Glacier National Park, Montana, mountain trail is blasted through rock to accommodate riders by replacing steep, tortuous route to Ptarmigan Lake. Bore is 183 ft. long and 9 ft. wide. Construction was directed by C. E. Randels *(left)*, park engineer, assisted by George W. Reed.

©P&A

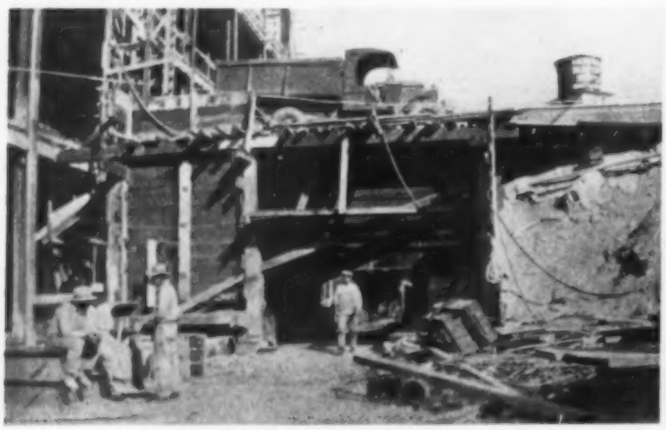
BUILT IN THREE WEEKS. This elaborate set, depicting a scene in Paris, was rushed to completion for Radio Pictures' wartime comedy, "Half Shot at Sunrise." The construction crew worked continuously in 8-hour shifts until the job was done.

NATURE BUILDS A BRIDGE. Freak crossing of stream near Pleasant City, Ohio, is made by trunk of water elm 1 ft. in diameter. Post at center is dead shoot.

JOINT STRENGTH DEMONSTRATED. Tests of 30-in. pipe by East Jersey Pipe Co. at 1,160-lb. pressure rupture 5/16-in. steel plate but fail to damage lock-bar joint.

Concrete Wall Forms Raised by SCAFFOLD JACKS

THE use of batteries of scaffold jacks to raise concrete wall forms from one floor level to the next was one of a number of features in the construction of a six-story steel-frame storage and laboratory building for the Brunswig Drug Co. in Los Angeles. Because of the nature of the use to which it is to be put, the 100 x 150-ft. building is of especially heavy construction. It is fireproof with concrete walls and slabs, one side being built up with brick filler walls to allow for a future annex.



EARTH BACKFILL *(below, right)* **for outside walls is stored in pile which serves also as ramp** *(left)* **for motor trucks. Cement is stored under ramp.**

In order to speed up the concrete pouring, Macdonald & Driver, the general contractors, constructed a permanent form panel for each of the three concrete sides of the building. The panels were heavily and rigidly built so that they could be re-used, after cleaning, for each floor's pour. Each panel was attached at 10-ft. intervals to a single plank scaffolding suspended above it by wire suspension ropes tied directly to the wall beams of the building several stories above the work. The suspension ropes passed through jacks on the scaffolding, spaced 10 ft. apart.

After one pour of concrete had set and the form panel had been broken away, one man was stationed at each jack on the scaffolding and, by pumping the wires around the drums in unison, the entire panel was lifted in one piece to its new location. No more than 15 min. usually was required to raise a panel one floor. Cost of renting the jacks and diverting men from other work to raise the panels was much less than the cost of the usual method of breaking the forms apart and rebuilding them at each new level. Because each form panel was to be used a number of times, great care was taken to give it a smooth face. Careful cleaning of the form gave a much cleaner finish than usual.

The contractors used a rolling scaffold to strip the inside deck forms, effecting a saving of about 30 per cent in this work.

The unusual weight of the building necessitated exceptionally heavy foundations, the plans providing for six rows of eight footings each under the structure. Each footing was in the form of a stepped-back pyramid, approximately 5 ft. deep and 16 ft. square on the bottom. A 1¼-yd. shovel was used to excavate for the basement, the dimensions being extended beyond the building lines because of the projection of the outside rows of footings.

A ⅜-yd. shovel was then moved into the hole and a 5-ft. deep trench was dug for the first row of footings. Forms were built up and after the footings had been poured, the trench for the second row of footings was started, the shovel casting the soil directly into the areas that were to be backfilled between the footings in the first trench. A new trench was dug each morning, the footings in the adjoining trench having been poured the afternoon before. The distance between the trenches was such that by hand work, it would have been necessary to handle the dirt twice. Aside from a small amount of hand shovel work to square up the base of each footing, all of the digging and casting work was done by the shovel. This method, in view of the size of the

FOOTING TRENCH FILL outside building is placed by light crawler-mounted revolving shovel.

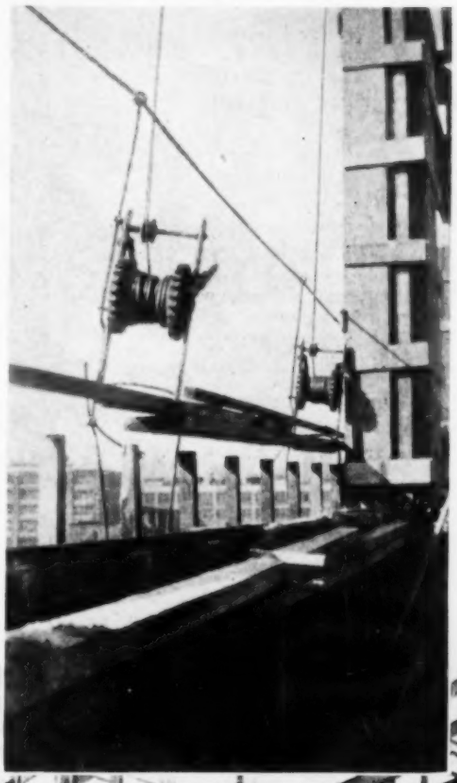
foundations, was much more rapid and inexpensive than digging the footing holes out by hand.

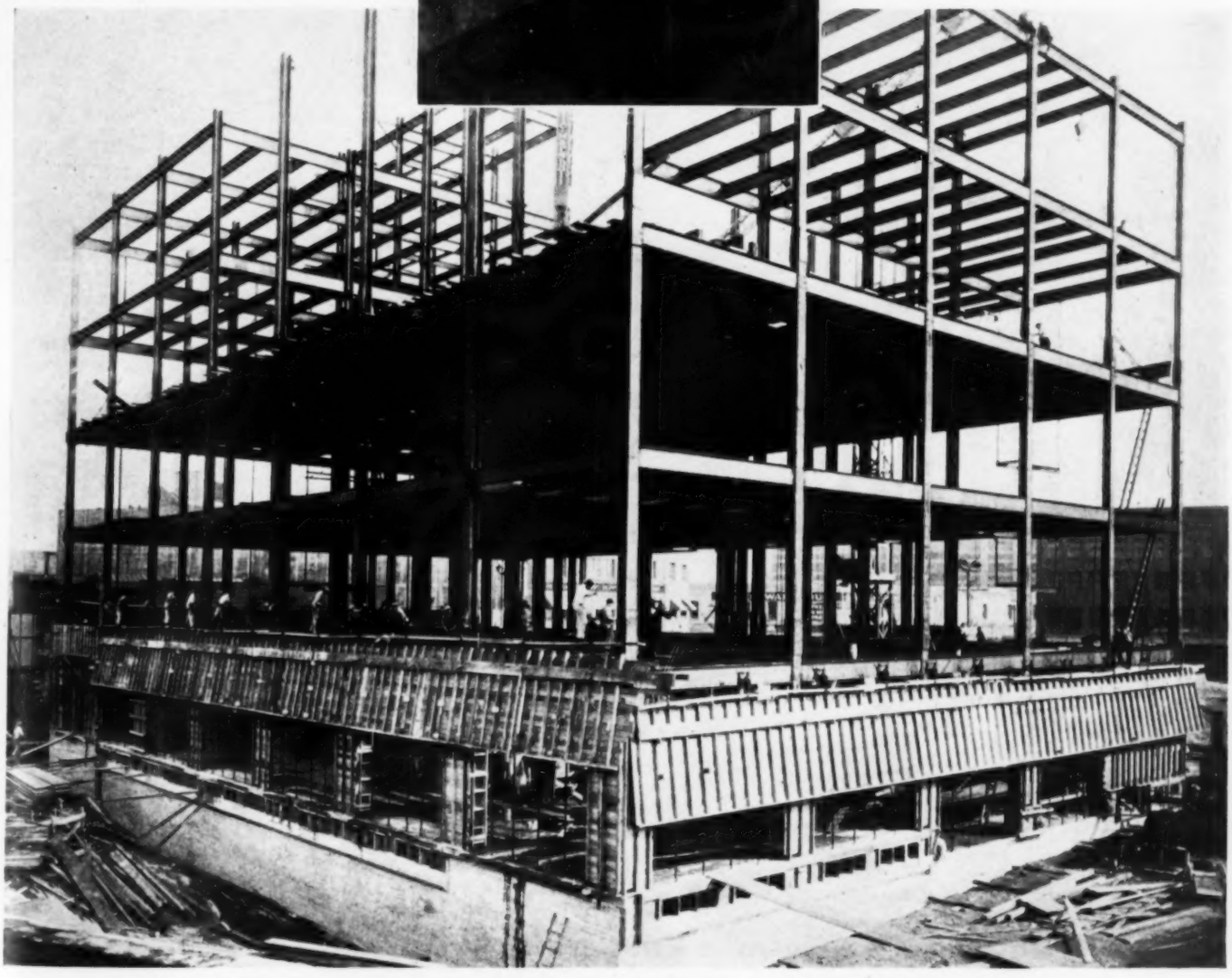
The projection of the outside wall footings left an open trench surrounding the building. In carrying away the spoil from the basement excavation, nearly enough earth was left at the site to backfill this trench, the earth being used during construction as a truck ramp leading from the ground level to the material bunkers above the concrete mixing plant. A passageway under the ramp, next to the mixer, was used to store cement away from the weather. This arrangement obviated the use of man power, aside from the dumping of cement, in moving materials to the mixer.

A shovel and two small trucks were later used to backfill the earth from the ramp against the outside walls of the building. Part of the contract was to reduce the grade along one side of the building, and this was delayed until after the basement walls had been poured. The small shovel was then used to cut away the earth, casting it directly into the trench along that side of the building. All hand work, aside from cleaning up, was eliminated. This earth, plus the earth from the truck ramp, was just sufficient to bring the ground around the building up to grade.

In order to do away with the confusion and hazard of permitting lunch-box sales girls to go through the job and to sell to the workmen, the customary procedure in the Los Angeles area, the contractors erected a small room adjoining the job office for the use of the lunch box concessionaire. This permitted the men to buy their lunches and eat them on the job, without distracting their attention while at work. Lumber for the small room was furnished by the contractors, and the labor was charged for. This arrangement also permitted the concessionaire to carry many more sundries than he could otherwise.

HOW SCAFFOLD JACKS are tied to the form panels.





FORMS HANDLED AS UNITS on two sides of building by means of series of scaffold jacks. Workmen on left panel are each stationed at a jack and raise form in unison. Form panel at right has been varied to position for small pour but has not yet been tied in to building.

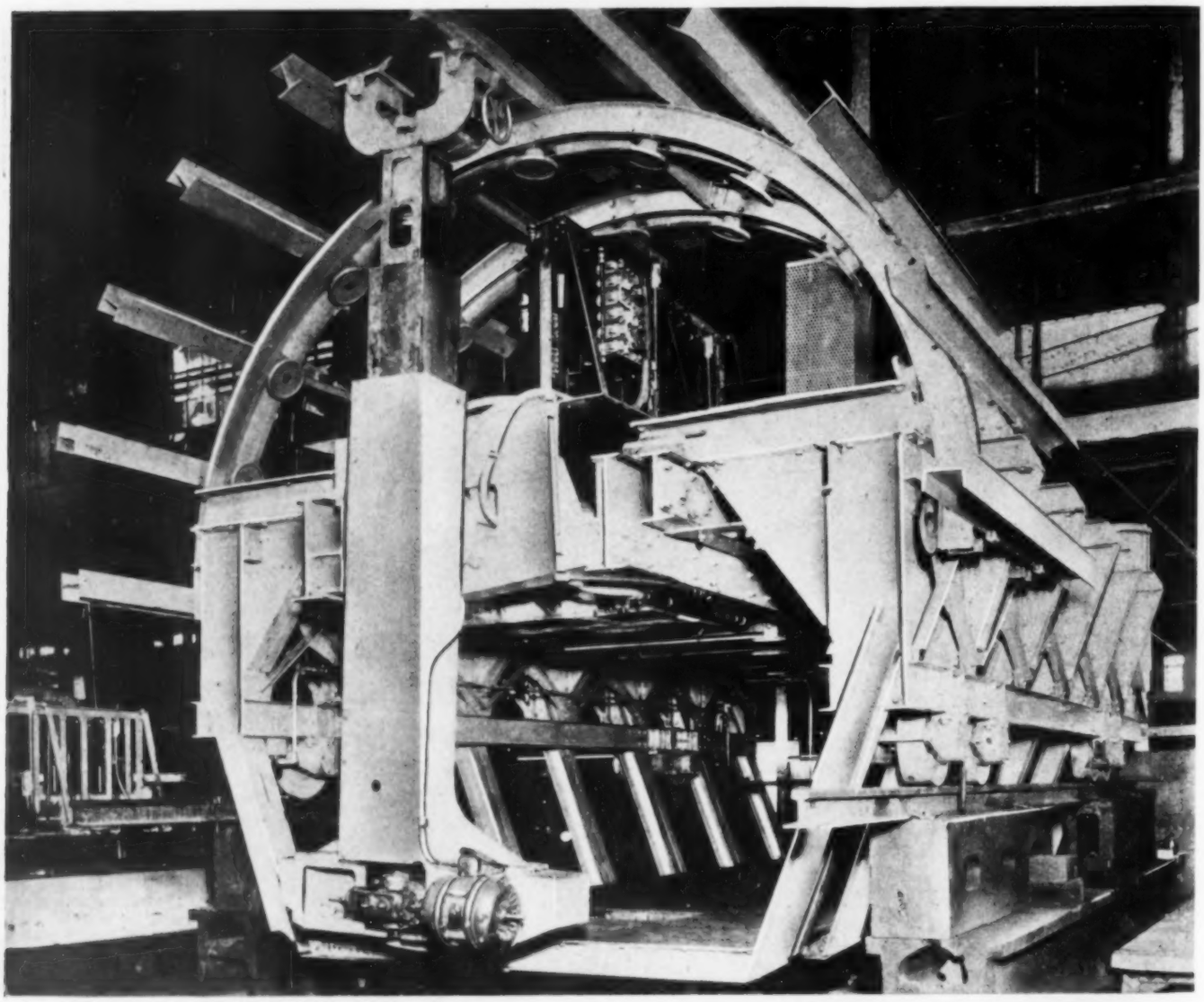
Building New York's Subways—VII

TRAVELING ERECTOR

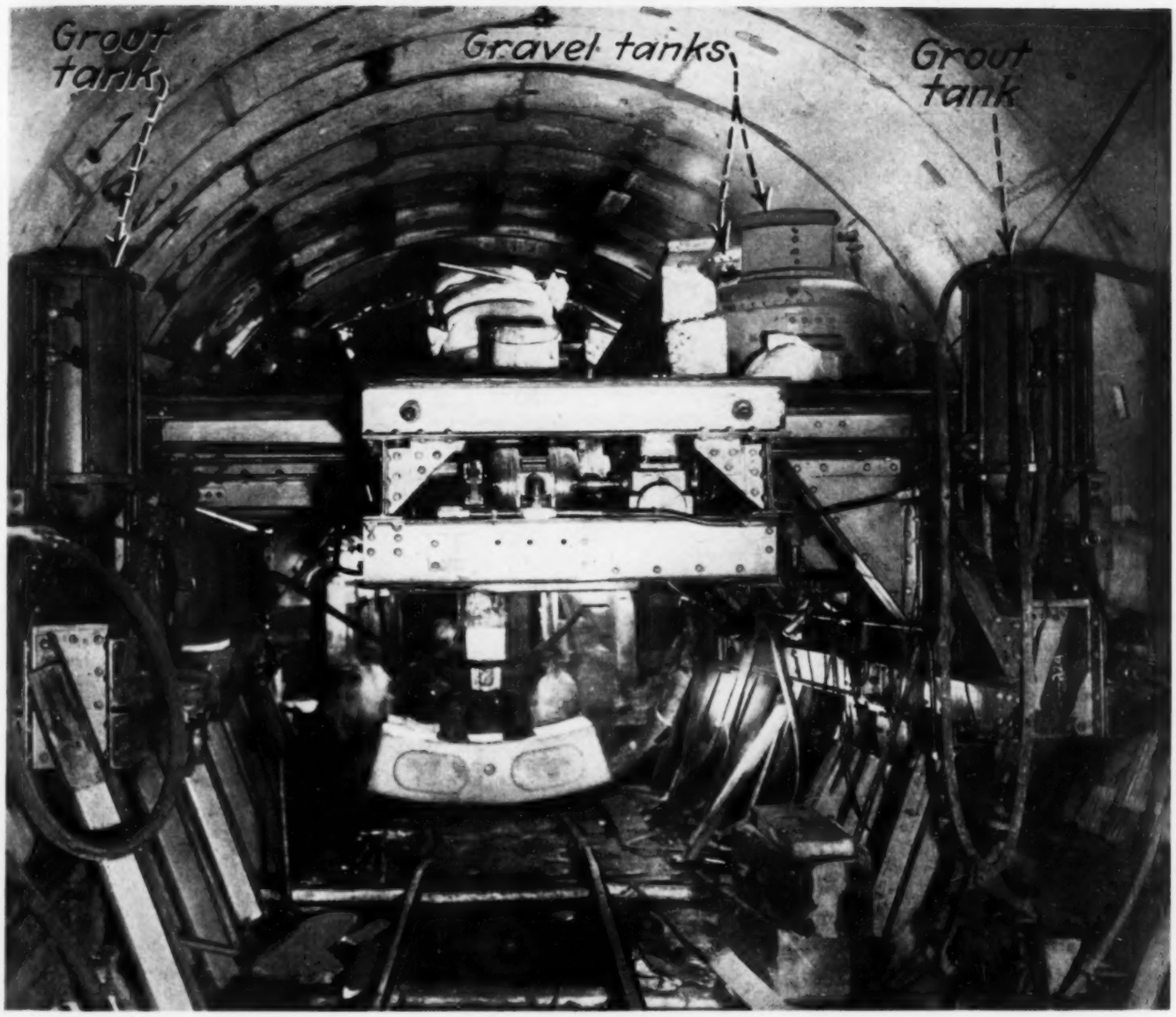
Places Precast-Concrete Block Lining in Land Tunnels Shield-Driven at Atmospheric Pressure

CONCRETE block-lined shield tunnels on one Brooklyn section of the New York City subway system offer a decided contrast to the shield-driven East River tubes, with cast-iron lining, described in last month's *Construction Methods*. Although the method of driving the tunnels is fundamentally the same, the lining material and the equipment for erecting it are so different as to make the Brooklyn section unique in the annals of subway construction. The four tunnels included in the contract are the first circular shield-driven railroad tubes to use precast-concrete blocks for the lining. As the tunnels are above the groundwater table, they were driven without need of compressed air in the headings.

The express and local tracks diverge near the south end of the section. Each of the two express tracks is 1,540 ft. long, and each local track is 1,925 ft. in length. Of 24 bids received from six contractors on four proposed construction schemes, the lowest total price of $2,974,884 was submitted by



SELF-PROPELLED TRAVELING ERECTOR is carried by two pairs of wheels on each side running on steel rails. Upper platform of traveler supports movable carriage on which telescoping erector arm is mounted. Manually adjusted H-beams on two steel centers support upper half of newly placed lining. **PRECAST-CONCRETE TUNNEL LINING BLOCKS** *(above)* have matching lugs and recesses.



ERECTOR ARM HAS LIFTED BLOCK from flat car, which has withdrawn from lower deck of traveler, and is ready to swing block to position in ring. Erector jaws are screwed up in grip holes of block. Rear end of movable carriage *(at center)* carries electric motor which propels it forward and back in placing key block.

the Cornell Contracting Corporation for express and local tracks in concrete tunnels. The successful bidder arranged with John F. O'Rourke to use his scheme of reinforced-concrete block lining, erection machinery, and gravel packing.

Tunnel Lining—As built, the four tubes have an inside diameter of 16 ft. 9 in. and an outside diameter of 19 ft. 9 in. The concrete block rings are 2½ ft. in longitudinal dimension and are made up of ten equal segments separated by radial joints ¼ in. wide. A radial joint was formed by inserting two ⅛x2-in. shims, corrugated to ¼-in. thickness. Each block is 6 ft. 1 in. long, measured on the chord of the outside arc, contains approximately 0.8 cu.yd. of concrete, and weighs about 3,200 lb.

Blocks of adjoining rings are "interlocked" by a system of lugs and recesses, shown in the first photograph accompanying this article. Each block has two lugs 1½ in. high on one side and two recesses 1¼ in. deep on the other. The projections and recesses are spaced to stagger longitudinal joints of adjacent rings. By making the recesses shallower than the projections, the designer of the blocks arranged to transmit the reaction of the shield jacks through the lugs and, also, to leave a ¼-in. circumferential joint for grouting.

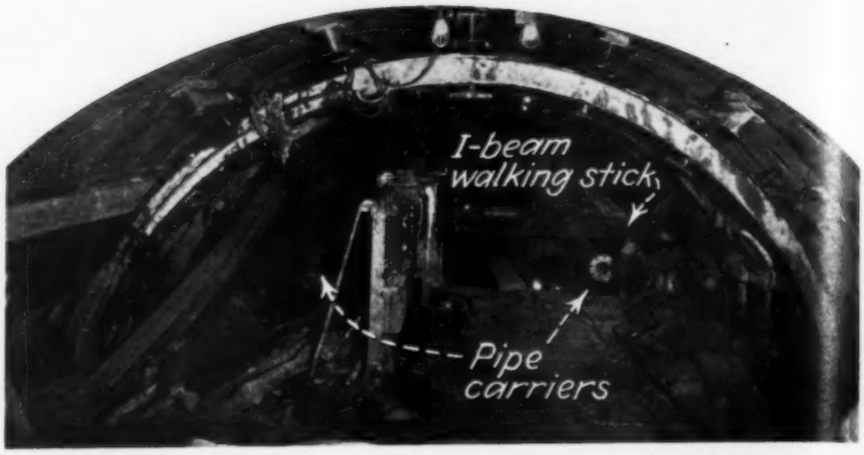
RAIL SECTIONS, 2½ ft. long, on which erector travels, are carried on steel shoes suspended from grip holes of side-wall blocks.

Each block contains a radial hole for shooting gravel into the void outside the lining left by the shield. Grout holes in three blocks of each ring penetrate 8 in. into the blocks and turn a right angle, belling out to the circumferential joint. Two grip holes 6 in. deep, on the inside face of the block, afford a hold for the jaws of the erector arm.

Shield Design—The shield was of conventional design, with the excep-

tion that it carried no erecting apparatus. Twenty 8-in. hydraulic jacks had available an ordinary pressure of 5,000 lb. per square inch, making a total possible reaction against the concrete lining of 2,500 tons. The outside diameter of the shield was 20 ft. 4 in.; the skin thickness, 2¼ in.; and the overall length, 17 ft. 11 in. Gross weight was about 150 tons. The shield differed from those used in river tunnels in that its tail was beveled, being shorter at the invert than at the crown.

Traveling Erector—The practical difficulty of building a concrete-block tunnel with the ordinary erecting apparatus, attached to the shield, led to the design of a separate traveling erector, the most interesting piece of equipment on the job. Photographs on pp. 46 and 47 reveal the principal features of the erector. All its motions were driven and controlled by electrical equipment of G.E. manufacture. Electric motors propelled the traveler, operated the movable carriage supporting the erector arm, and actuated the erector arm itself. In addition to its erecting function, the traveler supported the arch of the tunnel lining during erection by means of a set of adjustable H-beams.



H-BEAM SUPPORTS are screwed and wedged up against upper half of tunnel lining. Beams support each block at middle and at both ends. As block is placed in upper half of new ring, beams are loosened and slid forward under it. Note steel walking stick and pipes anchored in shield pockets to carry it.

a key segment, the carriage moved back to let the erector arm pick up a block from a flat car on the lower platform, moved forward until the erector arm cleared the ring, and drew back the arm to insert the block into the gap at the crown of the ring. Procedure of this kind is necessary to place key blocks with radial joints. The electrical control panel was mounted on the front of the erector carriage,

BELT CONVEYOR in side of traveling erector discharges muck into cars at rear of machine. Heading crew shovels muck from shield pockets to lower deck of traveler and recasts it on to conveyor.

The erection traveler was 26 ft. long and 15 ft. 7 in. wide. It had two platforms: the lower, 27 in. above the invert, carried track for material and muck cars; the upper, 21 in. above the tunnel springing line, supported the movable carriage on which the erector arm was mounted.

The movement of this carriage enabled the erector to place the key block at the crown of a ring. In handling where the operator could keep close watch on the erector arm. The jaws of the erector arm were screwed up tight in the grip holes of the concrete block. They never failed to hold the block securely.

Two semi-circular steel centers erected on the upper platform carried eleven 6-in. 15½-lb. H-beams 9½ ft. long which supported the upper half of the last ring placed. The beams were adjusted by hand, were moved forward separately to support the blocks as placed, and were raised with screws to fit the rings already erected.

The erector traveler carried two tanks for gravel packing and two for grouting joints.

Construction Procedure—The Cornell Contracting Corporation drove two tunnels at a time, each heading being advanced with shield and erector. All four tunnels were started from the same shaft, at the point where the tubes converge. The two express tunnels were the first to be constructed, one being started three weeks before the other. Shields arrived in six segments and were erected on rails concreted into cradles at the bottom of the shaft.

Shoving—The soil encountered by the shields was variable, although always dry. It ranged from sand and gravel to hardpan and filled ground. The faces sometimes had mixtures of three materials. Procedure in shoving the shield was the same as that employed in cast-iron lined tunnels. The jacks shoved against the recesses in the blocks of the last ring erected. Wood blocks fastened to the rams of the jacks fitted loosely into the recesses and distributed the pressure, reducing it to a maximum of 1,250 lb. per square inch against the concrete. Each shove moved the shield forward approximately 2½ ft., the width of a ring.

Breasting—Breasting boards in the face prevented loss of ground. As usual in the breasting procedure, "stretchers" (struts) from the "soldiers" (studs) holding the breasting boards transferred the soil pressure back to the "walking stick" (horizontal beam) anchored in the lining, during the shove. The walking sticks used on this contract were 15-in. 17½-lb. I-beams, carried on pipes supported in

the shield pockets. This arrangement, for this type of lining, proved much superior to the usual timber walking stick, taken down and re-erected for each new ring.

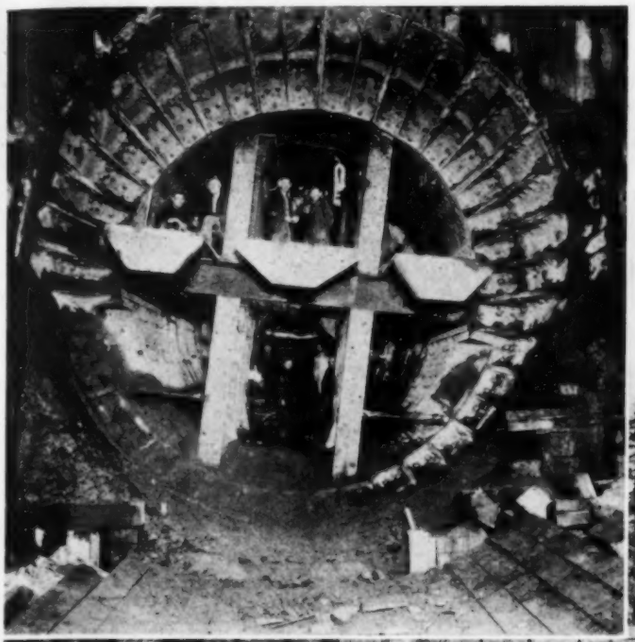
Erecting Lining—The erector followed the shield on rails laid in 2½-ft. lengths on shoes supported from the rear of the traveler and the shaft. Muck was shoveled from the six shield pockets to the lower deck of the erector and was recast on to a belt conveyor installed in the side of the traveler, which delivered the spoil to the muck cars.

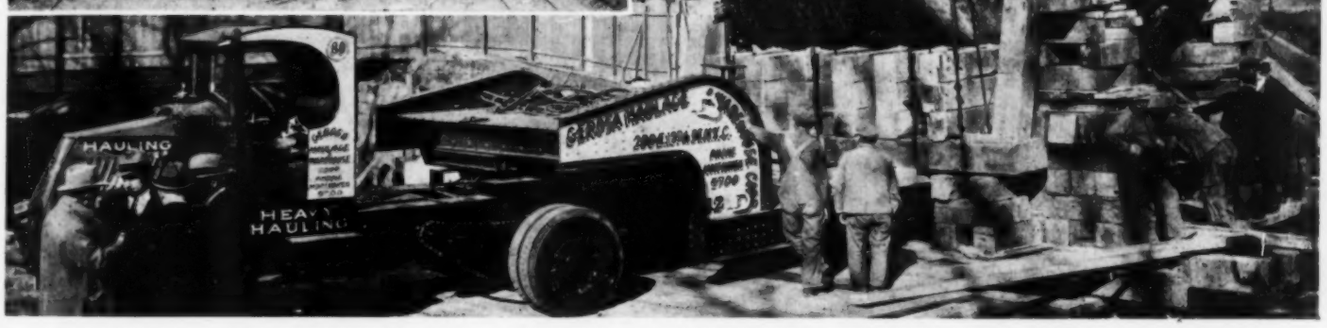
Gravel Packing—Gravel was shot, during the shove, through the holes in the second and third rings from the last erected, as soon as the individual holes had cleared the beveled tail. This gravel packing filled the annular void left by the shield and minimized settlement above the tunnel. The attachment of a felt strip 1 in. wide and ½ in. thick to the outside arc of each block confined the gravel to the void outside the lining, and, also, kept sand and other foreign substance out of the joints, assuring better grouting of the joints.

Grouting Joints—Grouting proved more difficult than gravel packing. To overcome the deficiency of imperfectly grouted joints, a back grout crew was put to work for one shift each day.

Moving Shields—When the shields had advanced to the shafts at the other ends of the express tunnel, they were jacked up the shafts intact, loaded on 65-ton trailers, and hauled ½ mile to the starting shaft, where they were lowered by the same method and put to work in the local tunnels.

Progress—After the tunnel crews became accustomed to handling the concrete blocks, three 8-hour shifts per day maintained a progress of six rings, or 15 ft. of tunnel, in each heading every 24 hours.





AT END OF EXPRESS TUNNEL *(left)*, cutting edge of shield shoves through bulkhead into shaft. In foreground is timber cradle which will hold shield while it is jacked up, intact, from bottom of shaft.

AT TOP OF SHAFT *(below)*, 65-ton trailer is backed under 163-ton load of shield and cradle. Load is jacked down on to trailer, which transports shield ½ mile over streets back to starting shaft.

grip holes of the side-wall blocks, as shown by the photograph. It erected a ring in the tail of the shield, and placed a steel dummy key temporarily, until the shield would shove ahead and allow the placing of the concrete key block. The dummy key was shorter than the space between the movable beams supporting the edges of the adjoining blocks, except for the 6 in. nearest the shield, which was of standard length. This temporary key was wedged in place to complete the ring until the erector moved ahead and replaced it with the concrete block.

To carry the tunnel around curves and to correct any deviations from true line and grade, caused by shoving in variable soil, concrete blocks were supplied to make up rings having tapers of ¾ in., 1⅜ in. and 2¾ in.

Mucking—Storage-battery locomotives drew flat cars carrying the concrete blocks from the shaft to the erector and hauled muck cars between the

Block Manufacture—The job required about 28,000 blocks. John F. O'Rourke, Jr., and Innis O'Rourke manufactured the blocks of 1:2:4 concrete mixed 2 min. and cast in machined steel forms seated on accurately machined cast-steel bases. A minimum of 30 days was specified before the blocks could be erected in the lining.

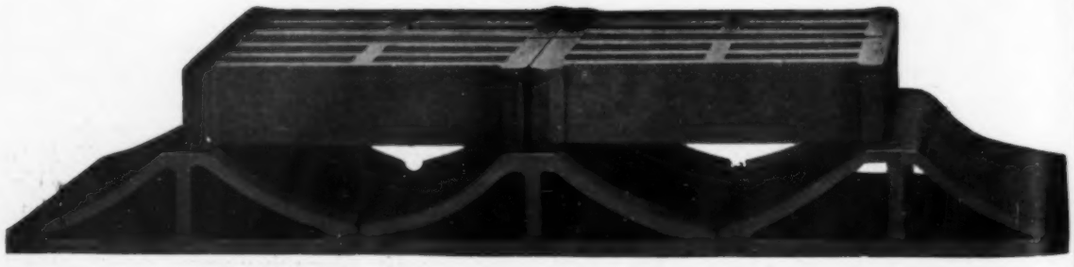
Personnel—The tunnels were built for the City of New York under the direction of the Board of Transportation, Robert Ridgway, chief engineer, and John R. Slattery, deputy chief engineer in charge of construction. J. O. Shipman is division engineer, C. E. Thomson, assistant division engineer, and W. H. Stuart, section engineer. For the Cornell Contracting Corporation, E. A. Herrick, vice president, and S. Kent, chief engineer, directed operations. John F. O'Rourke, inventor of the lining system, was the contractor's consulting engineer.

Structural Tile

Filter Tile

Paving Brick

Face Brick



In Cleveland "METRO" Filter Flooring

WHETHER it's a city of approximately a million inhabitants or one of 75 to 100 thousand population, "Metro" Filter Flooring provides definite advantages in the filtration system.

The one shown is used in connection with the Southerly Sewage Treatment Works in Cleveland and has proved very economical in operation.

The full opening grill permitting complete aeration and the channel construction which allows ample drainage and provision for flushing, are two important advantages of "Metro" Filter Flooring. Other points such as strength to carry the load imposed, leaving no exposed surfaces of concrete for sewage action, and freedom from constant supervision are features accounting for the low manitenance costs.

It will pay you to investigate "Metro."

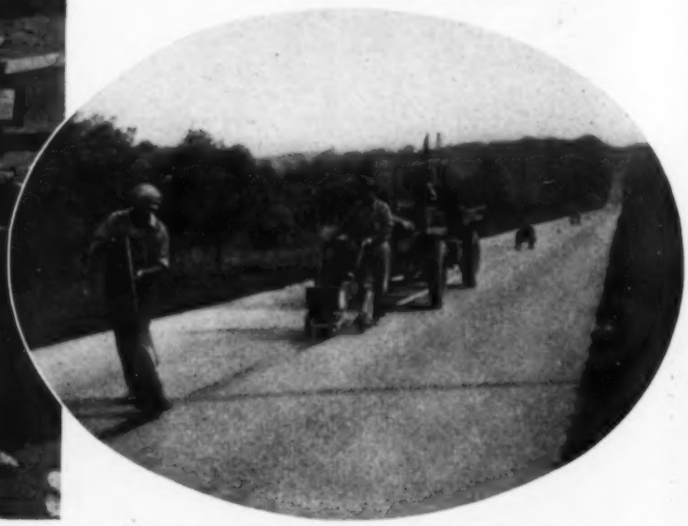
THE METROPOLITAN PAVING BRICK CO.
CANTON - - - - - - - - - - - - - - - OHIO

Getting Down to DETAILS

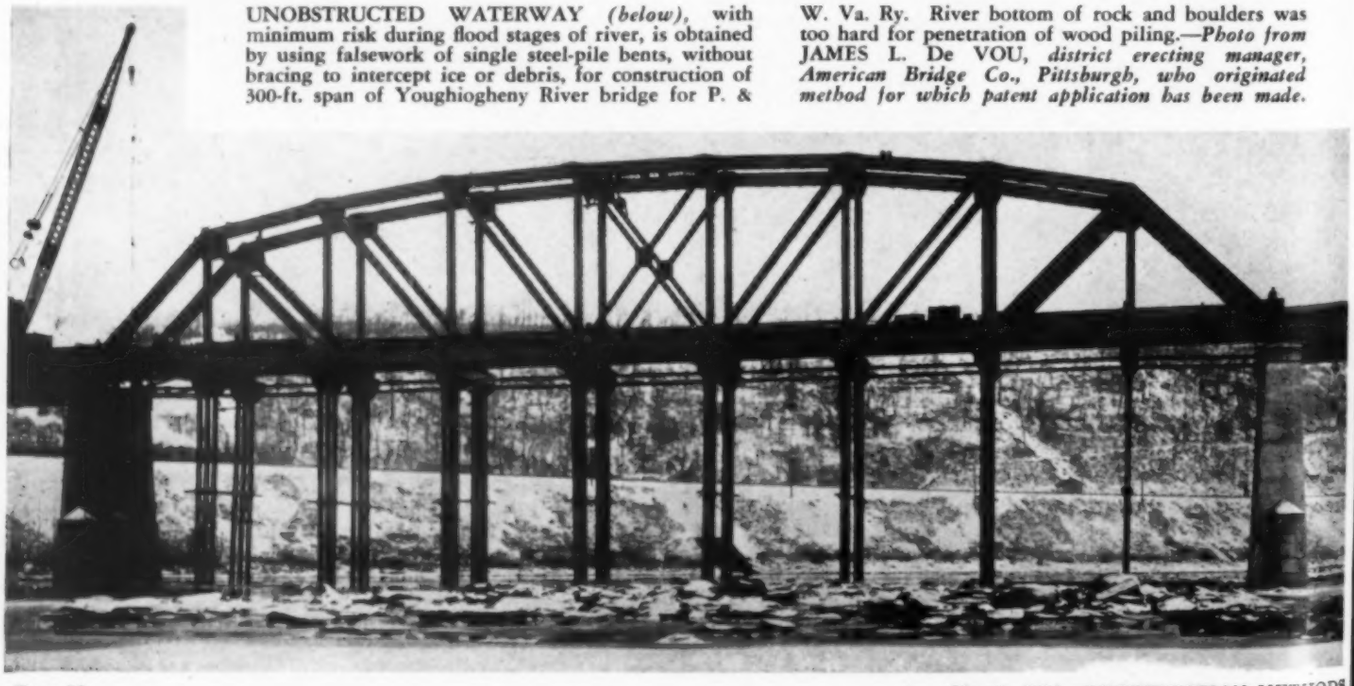
Close-up Shots of Job Methods and Equipment

ON CENTER JOINTS of weakened plane type for Bayshore concrete highway in California Basich Bros. Construction Co., of Los Angeles, laid ordinary ¾-in. square reinforcing bars 10 ft. long to exclude coarse material from 2-in. deep groove until joint was edged and finished.

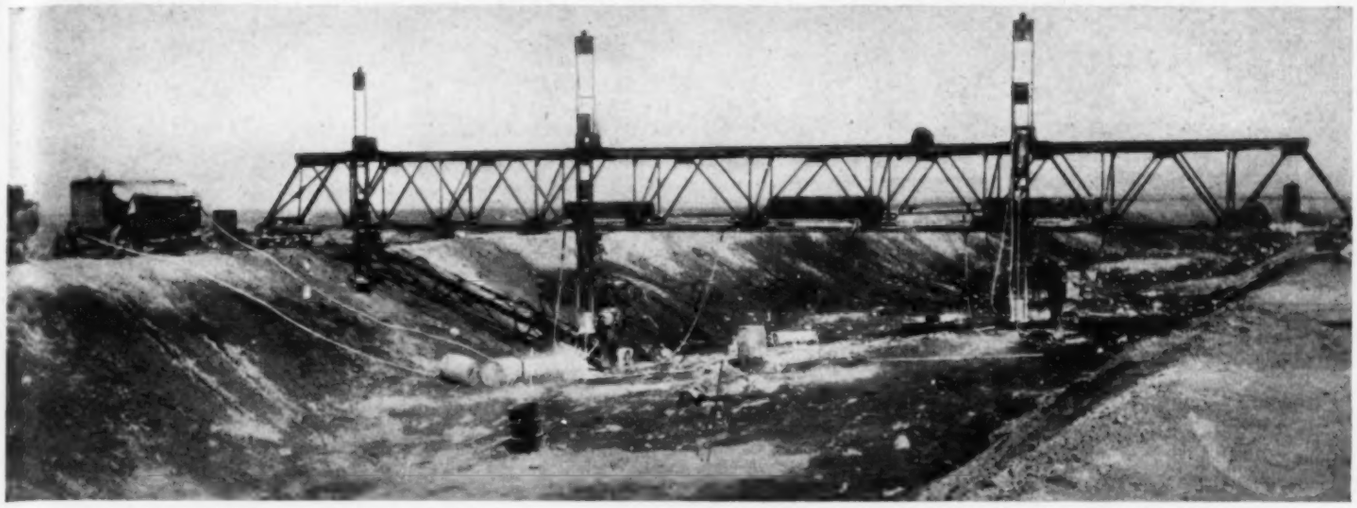
FOR POURING CONCRETE INTO NARROW FORMS the Lowensohn Construction Co., Cleveland, equipped the bottom of its 1½-yd. bucket with this double-leaf sliding gate. Discharge opening is easily regulated to produce concrete stream of desired width.



SAFETY FOR TRAFFIC LINE MARKERS. In North Carolina a truck is driven slowly behind the sweeper and painting machine to protect workers from injury by automobiles approaching from rear.



UNOBSTRUCTED WATERWAY *(below)*, with minimum risk during flood stages of river, is obtained by using falsework of single steel-pile bents, without bracing to intercept ice or debris, for construction of 300-ft. span of Youghiogheny River bridge for P. & W. Va. Ry. River bottom of rock and boulders was too hard for penetration of wood piling.—*Photo from* JAMES L. De VOU, *district erecting manager, American Bridge Co., Pittsburgh, who originated method for which patent application has been made.*



STEEL TRUSS DRILLING FRAME facilitates excavation by Mittry Bros. Construction Co. for 70-mile main canal of U. S. Bureau of Reclamation's Minidoka project in Idaho. Frame, with 84-ft. clear span, carries three Ingersoll-Rand Leyner type drills. Canal has base width of 40 ft. and bank height of 12 ft. Side slopes 1 on 1¼.—*Photo from* E. B. DARLINGTON, *Superintendent of Minidoka project.*

SELF-COMPUTING LEVEL ROD *(left and right)* for concrete cross-sections. JOSEPH R. MURPHY, senior resident engineer, Tennessee state highway department, who devised the method, describes it as follows:

"It is common practice in many highway departments, after taking readings every foot across the road, first on the subgrade and finally on the finished base or paved surface, to reduce the figures to elevations and subtract them to obtain the thickness of the slab. To eliminate this work I have devised a self-computing level rod extension.

"As illustrated herewith, a movable extension is attached to the end of the rod. The rod is first read on the benchmark and the original subgrade section taken in the usual way.

"In taking the final section of the finished slab, however, the level is set up so that the rod reading on the benchmark is about 1 ft. more than the original reading on the benchmark. The level rod device is then extended so that the final reading on the benchmark is the same as the original reading. With the extension clamped in this position the final section is taken. The difference between the original and final rod readings is the exact thickness of the concrete base.

FOR FINISHING ROAD SHOULDERS this boom and elevating bucket device, mounted on a Sterling truck, has been developed by the Geo. D. Whitcomb Co., Rochelle, Ill. Boom assembly is raised or lowered by hydraulic hoist, controlled from driver's seat, to regulate depth of cut up to 6 in. maximum. Buckets travel across shoulder and ditch, delivering soil to dump truck moving alongside machine. Auxiliary transmission on truck permits slow speeds.

Michigan Diverts River to Reroute Road

EXCAVATION FOR 15-ACRE LAGOON at end of river channel change provides fill for carrying relocated road over low ground. Depth of cut is from 10 to 12 ft.

By R. O. VAN ORDEN

Project Engineer
Michigan State Highway Dept.

AS A part of its master plan for the development and improvement of U. S. highway No. 12 from Detroit to Benton Harbor, Mich., the Michigan State Highway Department is building 3 miles of road from Comstock west to Kalamazoo as one of the first units to be improved. This project involves several unusual features, among which are the changing of the channel of the Kalamazoo River in two places, the creation of a 15-acre lagoon, the construction of a new three-span bridge, and protection of water rights of property owners whose land adjoins the river through the maintenance of the normal water level in the abandoned river bed.

The relocation project eliminates two dangerous grade-crossings of the Michigan Central Railroad and provides for a future rerouting of the trunk line away from the business district of Kalamazoo. The center line crosses the river at five points and traverses flood flats almost all of its length. The road, when completed, will be 56 ft. wide from shoulder to shoulder and will be surfaced with 40 ft. of concrete.

DRIVING TEST PIPE for bridge abutment at west end of lagoon. Gravelly subsoil in cut is dry, although separated from river only by narrow bank at right.

On account of the low ground crossed the grade is a fill from 4 to 8 ft. high for $2\frac{3}{4}$ miles, requiring 255,000 cu.yd. of material. To obtain earth fill, as well as to save the cost of four bridges, two channel changes, one, 1,900 ft. and the other 1,700 ft. long, are being dug. These channel changes, 120 ft. wide and from 7 to 9 ft. deep, will provide 110,000 cu.yd. of compacted fill. The remainder of the fill is to be made from the lagoon being dug at the west end of the second channel change.

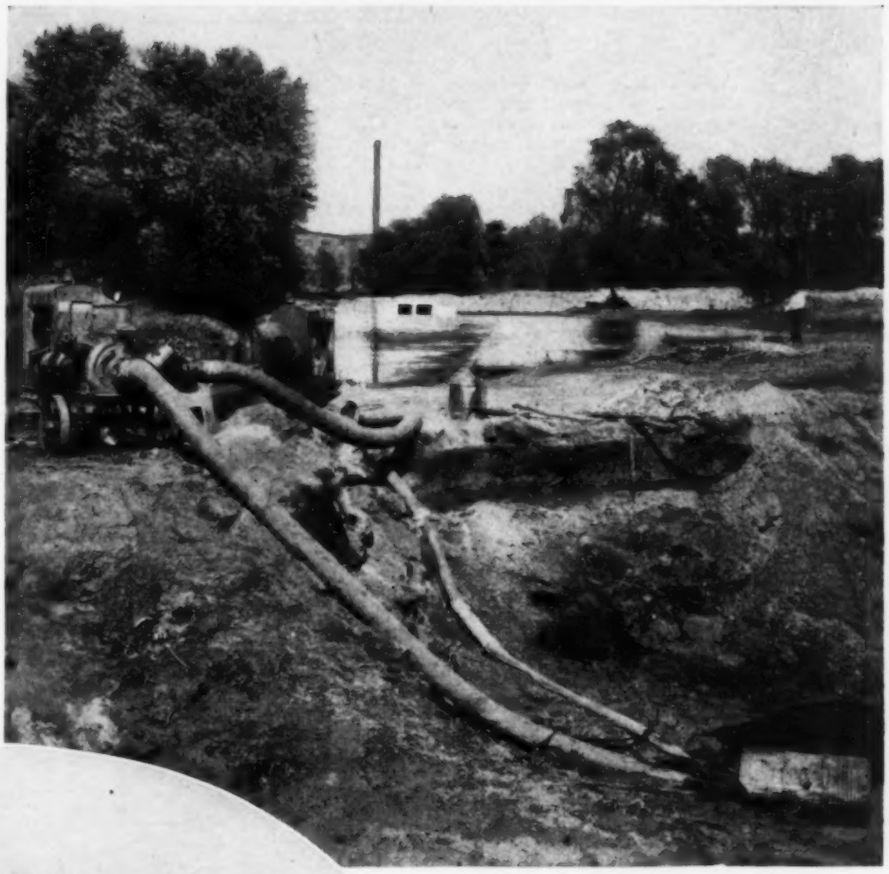
At the fifth crossing of the river, at the west end of the lagoon, a new bridge is being built. It is of steel deck-girder construction, has three equal spans of 65 ft., and provides for a 40-ft. clear roadway with two 6-ft. sidewalks.

An unusual feature of the construc-

tion of the bridge is the fact that when the excavations were made for the abutment footings close to the river, dry holes were obtained without the use of sheeting or well points, even at a depth of from 8 to 10 ft. below the water level.

Two theories have been advanced to explain this condition: One, that the pumping of water from wells by paper mills nearby has lowered the water table below the elevation of the bottom of the footings; the other, that the refuse wood-pulp and lime dumped into the river by the paper mills has settled and formed a waterproof coating.

This same condition exists at the site of the lagoon. Here, although the excavation is from 10 to 12 ft. deep, trucks traveled freely over the bottom until rain water accumulated in sufficient amounts to hinder their



TEMPORARY TIMBER BRIDGE *(below)* aids contractor in placing earth fill across river where channel changes are being excavated.

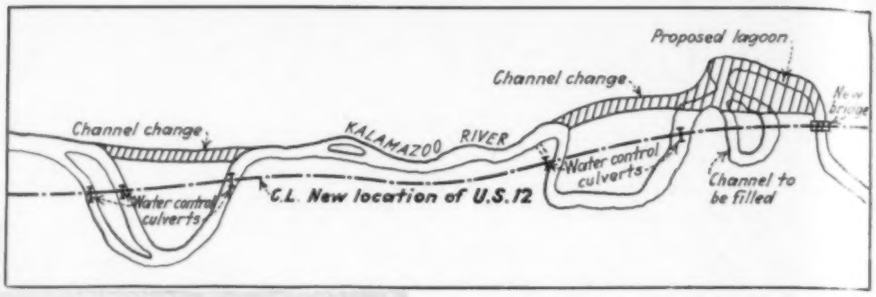
PORTABLE PUMPS unwater new channels during the digging operations. Water control culvert in background.

movements. Due to the almost total absence of seepage a very narrow bank is being left between the excavation for the lagoon and the present river channel.

A different condition prevailed at the channel changes. Here, seepage water was encountered in such amounts that pumps had to be installed to keep the excavation dry enough to permit the use of shovels instead of draglines. One-half of the channel is completed at a time, seepage and rain water being kept down low enough to permit the shovels to make the full depth of cut to grade with two 4-in. centrifugal pumps, located at the ends of the channels, and pumping direct into the river. By leaving dams across the ends and at the mid-point of the new channels it is necessary to pump only from the half of the cut in which the shovels are working. Final cleanup and removal of the dams is done with a 1-yd. dragline.

In order to maintain the normal

EARTH FILL *(left)* through wooded section is spread in thin layers by bulldozers on tractors to insure uniform compaction.



LOCATION MAP *(right)* **shows relationship of new highway route, present course of Kalamazoo River and channel changes.**

ON WEST CHANNEL CHANGE *(left)* **power shovels, working in tandem, remove earth to grade.**

flow in the present river bed during the digging of the channel changes and the lagoon, it was necessary to build temporary timber bridges at the points of crossing of the new line and the river instead of making the fill across the stream, for use in placing the earth excavated. These bridges are used until a channel change is completed, at which time they are taken up and the fill completed.

The State Highway Department will maintain the present normal water level in the portions of the river cut off by the channel changes, and at the same time insure a flow which will prevent the water from becoming stagnant by means of controlled flow of water into and out of the abandoned river bed. This control will be achieved by the use of double 6x6-ft. box culverts built in the present river channel at the points of crossing of the road and equipped with flashboards.

All excavation is being done with two Northwest gasoline shovels, one equipped with a 1-yd. dipper, the other with a 1¼-yd. dipper. Both machines are convertible into dragline or clamshell for cleaning up after water has been let in to the new channels. The excavated material is hauled in trucks to the fill where it is spread in layers of from 8 to 12 in. with two bulldozers mounted on Caterpillar 30 tractors. Twelve Union trucks, three 3½-yd. International trucks and six 2-yd. International trucks are being used to haul the earth. Two Russell road maintenance graders, powered with Caterpillar tractors, are used to keep the roads from the shovels to the fills smooth and free from deep ruts.

On the bridge, a Northwest crane has been used for making all excavations and for driving all piles, both for bearing and for sheeting around the two piers. Concrete is mixed in a 10-S Jaeger tilting mixer set up at the west end of the bridge. Concrete for the west abutment was placed directly into the forms by chutes. For the piers and the east abutment, the concrete is transported in a side-opening car over narrow-gage track to the crane which swings the car from the track to short chutes placed over the unit being cast. All aggregates are batched by weight.

Alex Jeffrey of Saginaw, Mich., is the general contractor on the grading and drainage structures, exclusive of the bridge. The paving is to be let as a separate contract upon completion and settlement of the grade. Harold Town of Galesburg, Mich., is the subcontractor who is building the culverts. The Wickes Engineering & Construction Co. of Des Moines, Iowa, has the contract for the bridge.

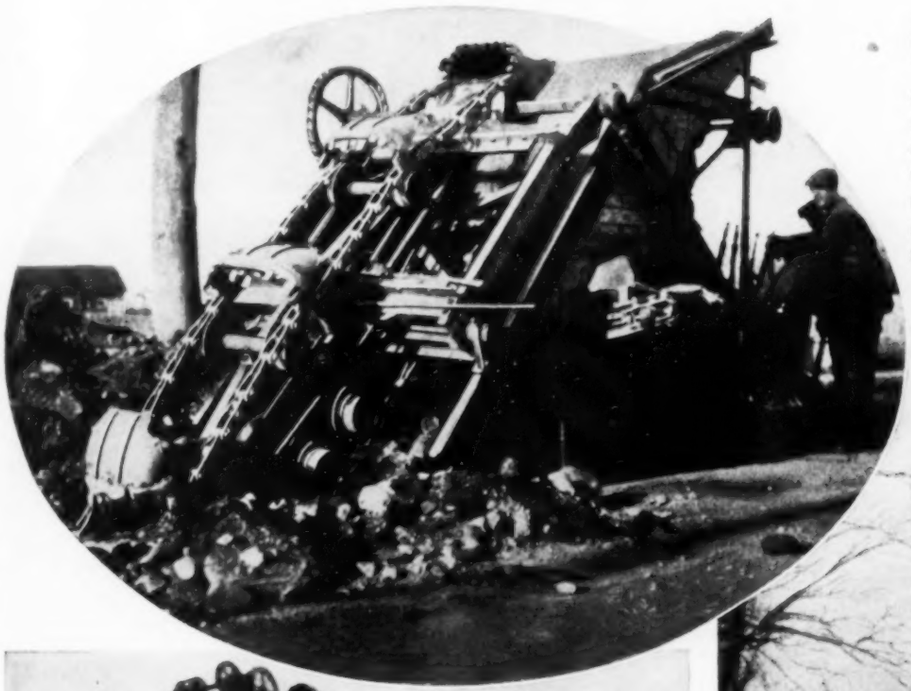
For the State Highway Department, R. A. Beers is resident construction engineer. Two project engineers have had direct charge of the contract for grading and drainage structures, A. O. Krogh until Sept. 15, 1930, and the writer since that date. V. B. McCracken is project engineer on the bridge job. John Wood is general superintendent for Alex Jeffrey, while Clyde Mathews is in charge for the Wickes Company.

MOBILIZATION OF EQUIPMENT for earth excavation and haulage on channel change and lagoon construction.

DITCHERS AND TRENCH HOES

Excavate for 110 Miles of WATER MAINS

LADDER-TYPE DITCHER cuts trench 24-in. wide for Bruno & Petitti. Machines of this type make best progress in sandy soil, free from large boulders.



CONSTRUCTION of more than 110 miles of cast-iron water mains, from 6 in. to 30 in. in diameter, for the Town of Warwick, R. I., brought forth a variety of methods and equipment on the part of the three contractors who installed the system. Not only in the operations of excavating and backfilling trenches did the contractors vary their equipment.

VERTICAL-BOOM DITCHER makes fastest progress on project, excavating narrow trench in sand.

TRENCH HOE places pipe as well as excavates ditch. Where digging is hard, because of presence of boulders, this type of machine is more efficient than either of others.

but also in constructing subaqueous lines they employed distinctive methods suited to the conditions encountered.

The three contractors prosecuted their work under the direction of Fay, Spofford & Thorndike, Boston, Mass., engineers of the project for the Town of Warwick. Bruno & Petitti, of Boston, constructed 58 miles of 6-in. to 16-in. main, including one 12-in. tidal underwater crossing 600 ft. long; H. W. Golden & Son, Inc., of Troy, N. Y., installed 50 miles of 6-in. to 30-in. pipe and built one 24-in. river crossing 200 ft. in length; and the R. H. Newell Co., of Uxbridge, Mass., laid five miles of 6-in. to 16-in. main, with a river crossing included in the 16-in. line.

Construction Conditions—All land mains were laid with centers 4 ft. 8 in. below the surface. Pipe in underwater crossings was covered by at least 5 ft. of earth. Where the current is swift, the earth cover is paved with rubble to prevent scour.

The material encountered was fairly uniform. It consisted of sand and gravel, with some boulders. The average trench was dry and free from groundwater. Much of the pipe was laid on streets which were not paved or on shoulders of paved roads, outside the paving.

Equipment and Methods — The photographs tell the story of the construction operations. Ladder-type ditchers and trench hoes excavated the land trenches. Their relative merits depended on the kind of material encountered. In sand, the ladder-type machines made more rapid progress. When the digging became difficult, because of presence of boulders, the trench hoes were more effective.

The two larger contracts were equipped with both types of machines to cut different trench widths as given in the following table:

Width of Trench	Name of Machine
	Bruno & Petitti
24 in.	Parsons ladder ditcher
	Insley trench hoe
20 in.	General trench hoe
18 to 24 in.	Barber-Greene vertical boom ditcher
	H. W. Golden & Son, Inc.
30 in.	Austin ladder ditcher
	P&H trench hoe
24 in.	P&H ladder ditcher
20 in.	Bay City trench hoe

The Barber-Greene ditcher made

TRIPODS AND CHAIN HOISTS *(left)* lay pipe behind ditching machines. Concrete trough in bridge sidewalk carries main across stream.

AT RIVER CROSSING *(right)*, H. W. Golden & Son, Inc., turns stream through diversion channel and builds dikes across river to keep site dry during construction of main. Backfill over pipe will be paved with riprap to prevent scour.

CURVED CRADLE *(left)*, with lower end resting on bottom of trench, places pipe at subaqueous crossing for Bruno & Petitti. Pipes are added at upper end of cradle as lighter moves ahead.

SLACKLINE DRAG SCRAPER *(right)* **operated by double-drum hoist on platform, excavates trench at river crossing for R. H. Newell Co.**

BOTTOMLESS DRAG-SCRAPER BUCKET *(left)* **has hinged door which drops to pick up load when bucket is pulled forward. Bamboo pole on bucket is marked to let operator know when he has reached finish grade of trench.**

the maximum rate of progress for a 10-hour day—1,700 ft. of trench for 6-in. and 8-in. mains in sandy soil. Average rates of progress per 10-hour day made by all types of machines on trenches for various sizes of pipe are given approximately in the following table :

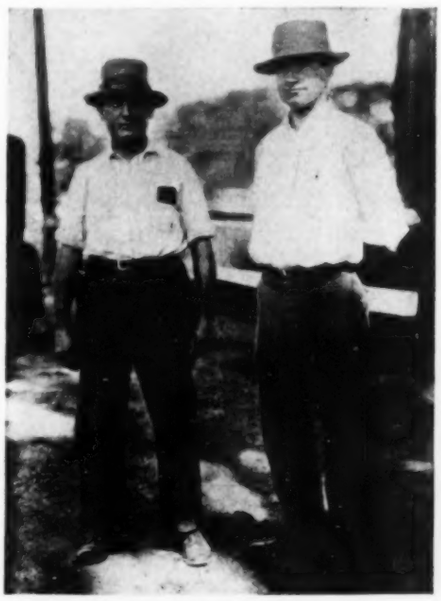
Pipe size	Ave. rate per day, lin.ft.
6-in. and 8-in.	1,000
10-in. and 12-in.	800
16-in.	600
20-in.	400
24-in.	350
30-in.	300

Water Crossings—On all water crossings, the contractors laid Metropolitan-type flexible ball-joint pipe. The photographs illustrate the various methods used. For their 24-in. line under the Pawtuxet River, H. W. Golden & Son, Inc., dug a diversion channel through adjoining low land and built earth dikes upstream and downstream to keep the site dry while they excavated the trench and laid the pipe. The backfill was paved with cobble-stone riprap.

In laying 600 ft. of 12-in. main across Bushneck Cove, Bruno & Petitti used a floating curved cradle which deposited the pipe in the trench as workmen at the surface added sections to the pipe and moved the cradle ahead. The cradle was curved so that the deflection at each pipe joint would not exceed 12 deg. A derrick lighter first excavated the trench with a clamshell bucket. The curved cradle, or chute, was mounted part of the time on the lighter and the rest of the time on pontoons. Its lower end rested on the bottom of the trench.

At the Pawtuxet River crossing of the R. H. Newell Co.'s 16-in. main, a slackline drag-scraper outfit of the Dance Co., Cambridge, Mass., excavated the trench. A 57-hp. two-drum Dance hoist operated a bottomless bucket, shown in one of the photographs. This bucket, 10 ft. long and 3 ft. wide, was equipped with a door which swung down to pick up a load when the bucket was pulled forward. The bucket dropped its load when moved backward. A vertical pole, mounted on top of the bucket, indicated the depth, below water level, at which it was digging.

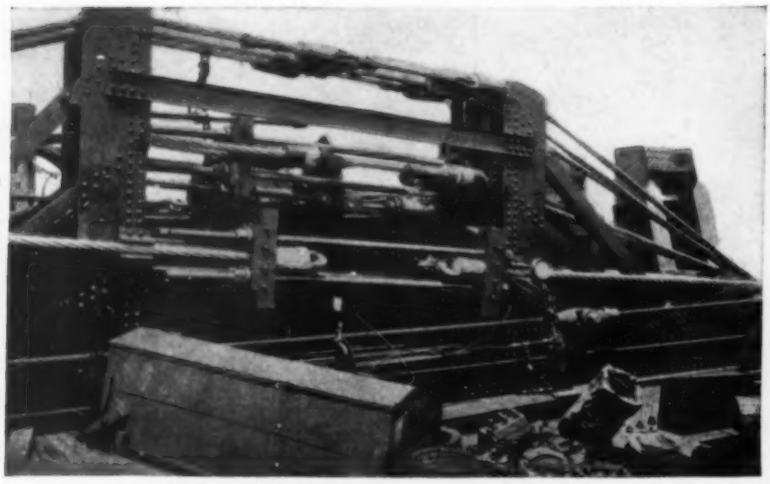
Personnel—For Fay, Spofford & Thorndike, Carlton North was resident engineer in charge of the H. W. Golden & Son, Inc., contract; W. L. Hyland was resident engineer in charge of all other work. The resident engineers acted under R. W. Horne, member of the firm. Joseph Bruno, Frank Petitti, and Alphonse Bruno directed various activities for Bruno & Petitti. Harold Templeton was superintendent for H. W. Golden & Son, Inc., and A. O. Bullard, for the R. H. Newell Co.



A. O. BULLARD *(left)*, **superintendent for R. H. Newell Co., and W. L. HYLAND, resident engineer for Fay, Spofford & Thorndike.**

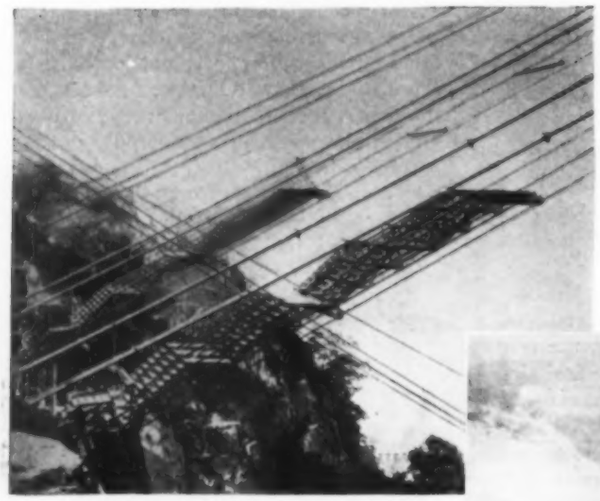
CABLE CONSTRUCTION

IN TWO PARTS—



1 ON TOWER TOP, short pennant connecting main-span and side-span lengths of footbridge rope is replaced by two threaded tierods holding yokes which bear against rope sockets. This connection allows 5 ft. of adjustment in length of ropes. Before raising to tower top, contractor lays rope lengths on river bottom and joins them with pennants.

2 ANCHORAGE CONNECTION *(right)*. No adjustment in length of footbridge ropes at this point is possible. Socketed ends of ropes fit into structural frame pin-connected to chain of anchoring eyebars.

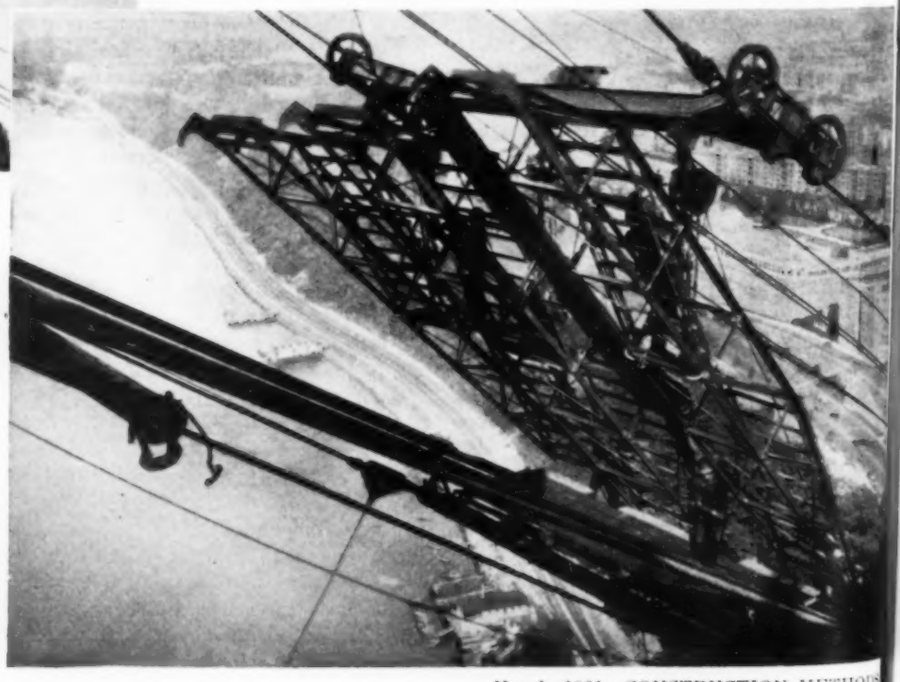


3 SIDE-SPAN FOOTBRIDGE DECK is made up of stairs and landings because of steep slope of side-span cables. To afford working position under cables, deck is suspended below footbridge ropes, which approach anchorage at higher elevation than cables.

4 PANEL OF SIDE-SPAN FOOTBRIDGE DECK *(right)*, is brought to position by carriage running on two 1¼-in. temporary track ropes. Hooks at upper end of panel will fit over pipe crossbeam attached to footbridge ropes. Pipe crossbeams were erected by spacing them along 2-in. ropes and suspending them from main footbridge rope groups above. Panel consists of three trussed, stepped sections connected by wood platforms.

UNPRECEDENTED size of the Hudson River suspension bridge, between New York City and Fort Lee, N. J., and great speed required in its construction led to extraordinary improvements in erection equipment and methods. The cable contractor, John A. Roebling's Sons Co., employed fundamentally the same method of cable construction invented by the firm's founder 75 years before, but it added every improvement which would facilitate and expedite the spinning of the 107,000 miles of wire in the four parallel-wire cables, each 36 in. in diameter.

Aerial spinning of parallel-wire cables for a suspension bridge



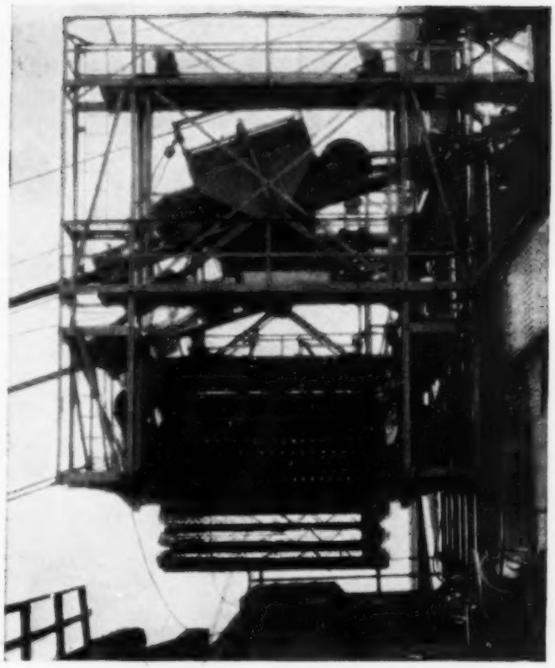
on Hudson River Bridge

Part I—ERECTION OF FOOTBRIDGES

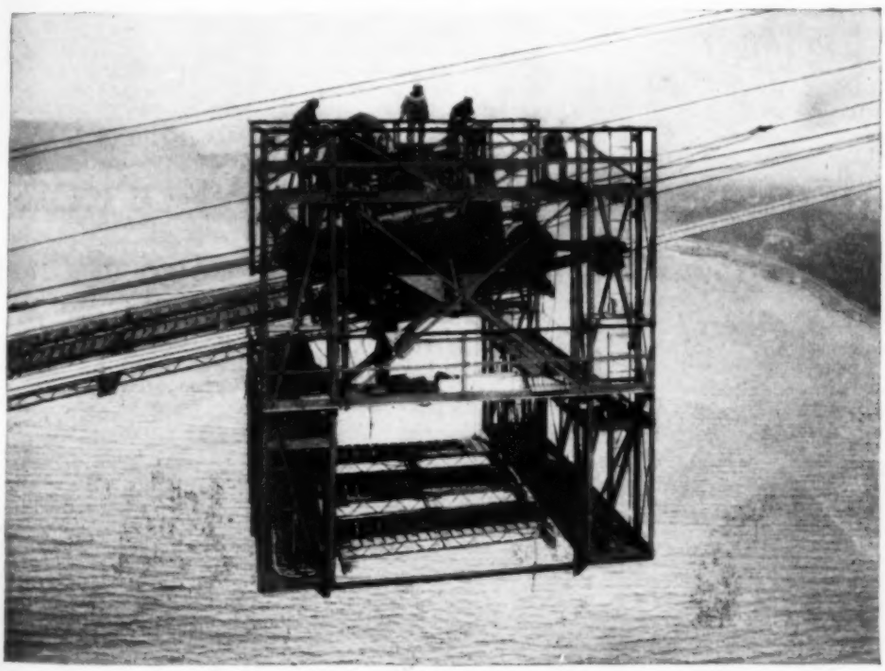
was described in *Construction Methods*, April, 1930, p. 52. This article portrays only the new developments in footbridges on the Hudson River bridge. Next month's issue will describe improvements in spinning equipment.

The four 36-in. cables are arranged in two pairs 106 ft. apart, with the two cables of a pair spaced 9 ft., c. to c. A footbridge under each pair of cables was supported by two groups of nine $2\frac{7}{8}$-in. wire ropes, 22 ft. apart. Discarding the former method of using footbridge ropes which are continuous from anchorage to anchorage, the cable contractor pre-stressed the ropes, cut them to main-span and side-span lengths and socketed them at the plant at Roebling, N. J.

The steep slope of the side-span cables led the contractor to design the footbridges for these spans in alternate stairs and landings. Because the side-span footbridge ropes approached the anchorage at a higher elevation than the cables, it was necessary to suspend the footbridge deck from the ropes to obtain a working position under the cables. To erect the main-span footbridge sections a traveling carriage moved over the footbridge ropes.

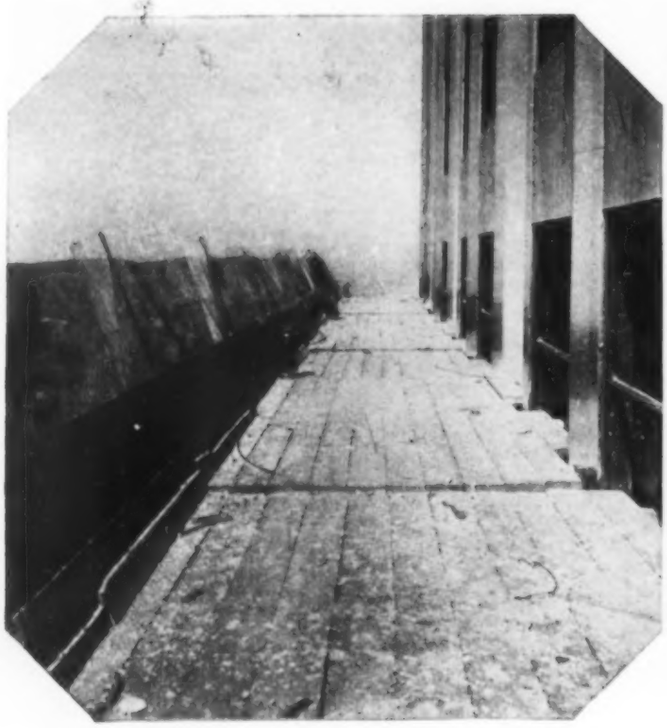


5 MAIN-SPAN ERECTION CARRIAGE picks up load of ten light, welded, structural foot bridge decking sections, each 25 ft. wide by 12 ft. long. Overhead crane on tower top lifts sections from ground in skip. Small boom places sections on hand car. Contractor uses four carriages on main span.

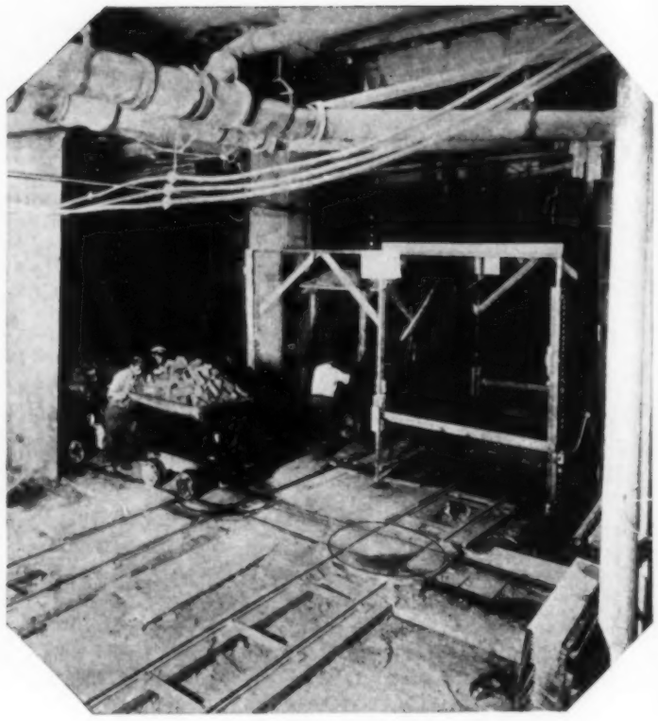


6 TRAVELING ON FOOTBRIDGE ROPE GROUPS *(left)*, on wood wheels, carriage erects deck sections, which are clamped immediately below footbridge ropes. Erection starts at center of span and works toward tower. Hoist on tower driven by 100-hp. electric motor operates carriage on endless hauling rope. Wood flooring on footbridge deck is omitted directly below cables to save weight.

7 WITH DECKING COMPLETED *(below)* and steel tramway headframes erected, footbridges are ready for cable spinning. Heavy wire mesh over floor openings under cables and steel guard rail protect workmen. Telephone and electric signal cables are in place along guard rails. Five crosswalks in main span stiffen footbridges. Below footbridge at left can be seen ropes tying into storm system to resist wind uplift.



CATCH-ALL, solidly planked over, is located below the stone-setters, to intercept falling objects. Fire extinguishers are placed every 30 ft. along edge of flooring, on which storage of material is prohibited.



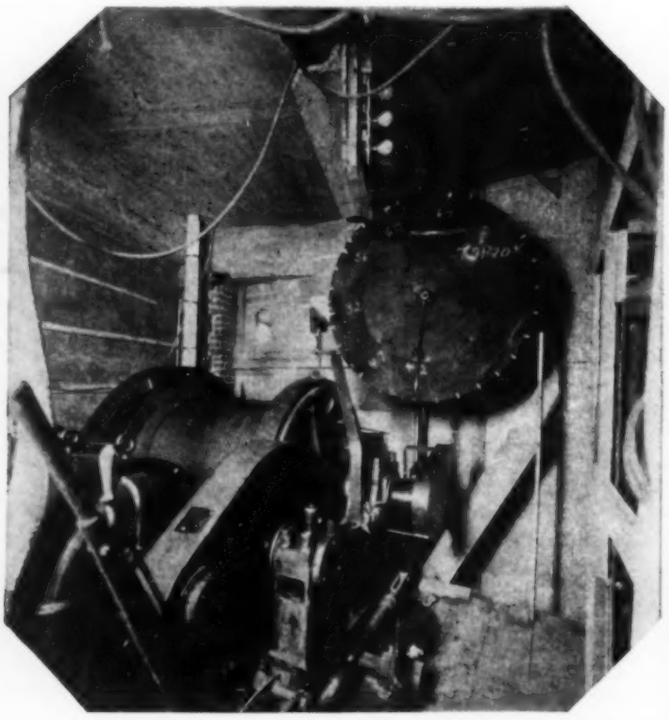
INDUSTRIAL TRACK SYSTEM, with numerous turntables, is installed within building to deliver brick, stone and mortar safely in flanged-wheel cars. Each car load is equivalent to eight men with wheelbarrows.

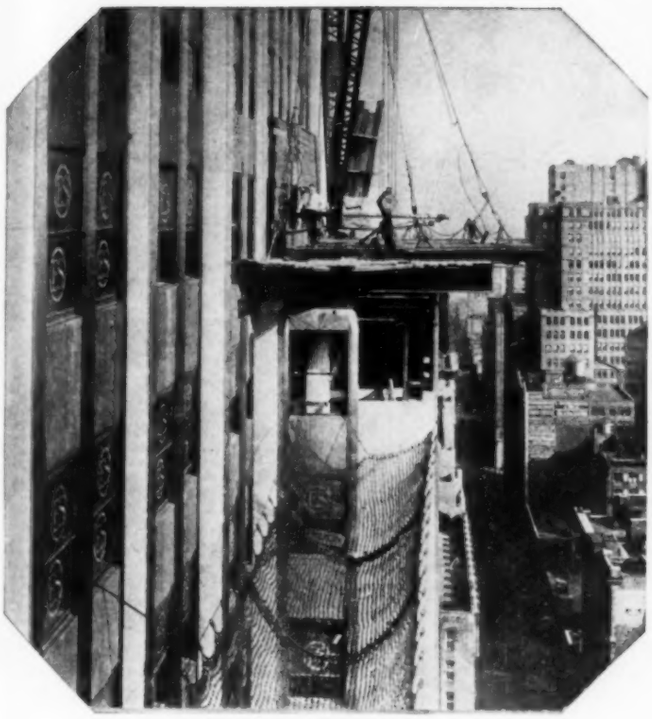
To Safeguard Construction Workers

A Few of the Accident Prevention Measures Adopted by Starrett Bros.

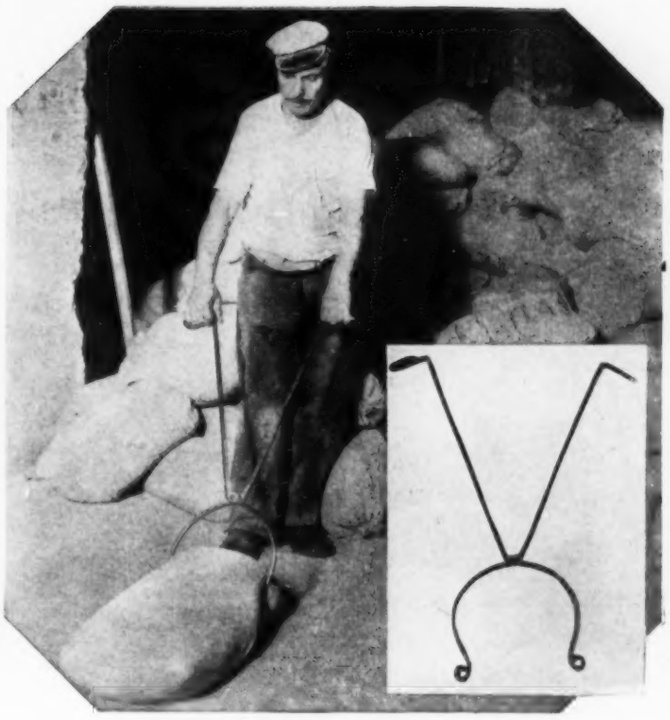
TELEPHONES allow signal man to communicate directly with hoist runner. Note manually-operated chocking device on hoist platform, at left, ready to lock wheels of car carrying load of mortar.

DIAL WITH FLOOR MARKINGS, supplemented by system of colored electric signal lights, enables engineer to operate safely hoists carrying workmen between floors of the 85-story building.





ROPE NET is hung on wire rope cables at twenty-fifth floor between first two landing stages. It is placed to catch small falling objects or men in case they should tumble from landing stages.

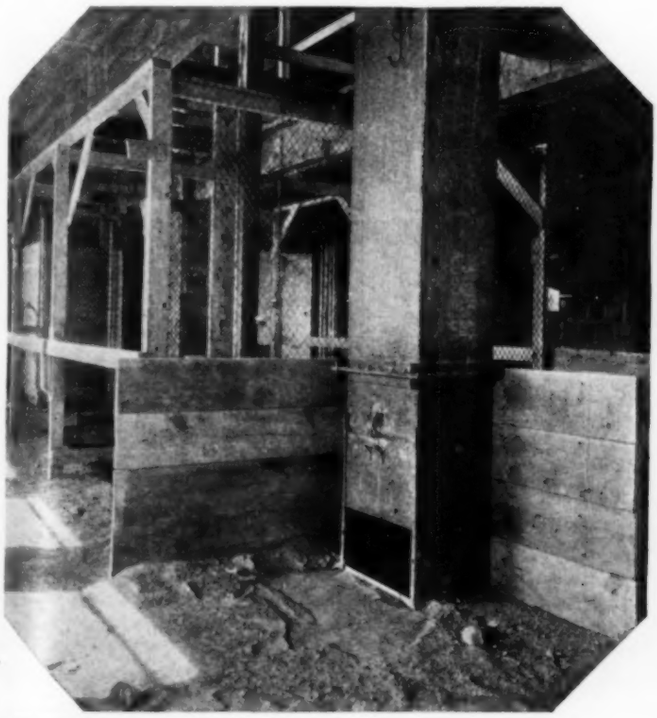


SPECIAL TONGS, devised by Superintendent Bowser of Starrett Bros. & Eken and made by the contractor's blacksmith, minimize back strains and hand injuries in moving bags of cement.

on 85-Story Empire State Building

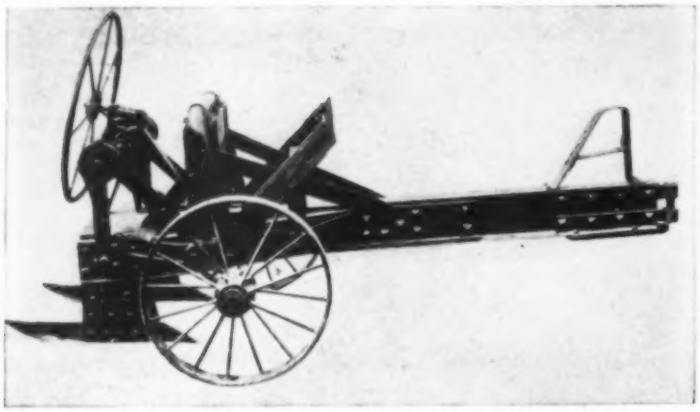
& Eken, Inc., as Reported by Building Trades Employers' Association

METAL CHUTES, in sections, bolted together, carry light debris directly to hopper on street floor, leaving material hoists free for other purposes. In background, note wire enclosure of elevator openings.

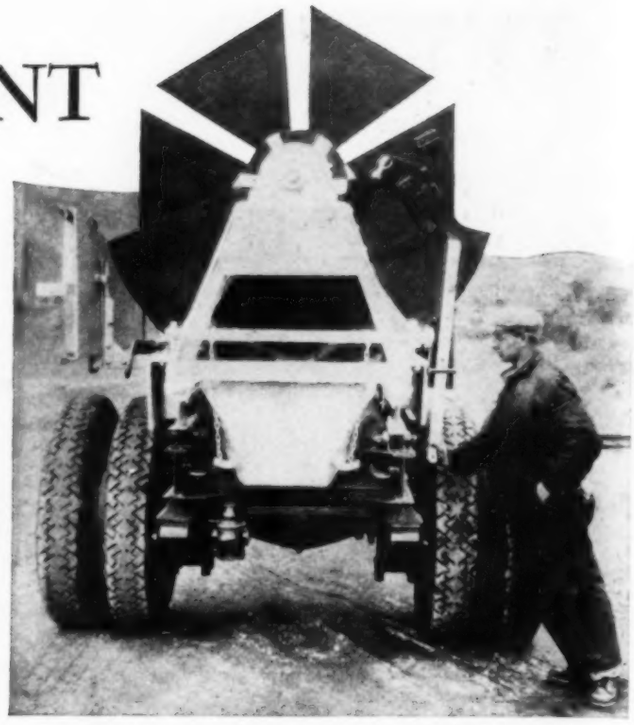


TEMPORARY STAIRWAYS are used, where possible, as a measure of accident prevention instead of ladders. They are wide, substantially constructed and equipped with mid-rails and smooth hand rails.

NEW EQUIPMENT *on the Job*

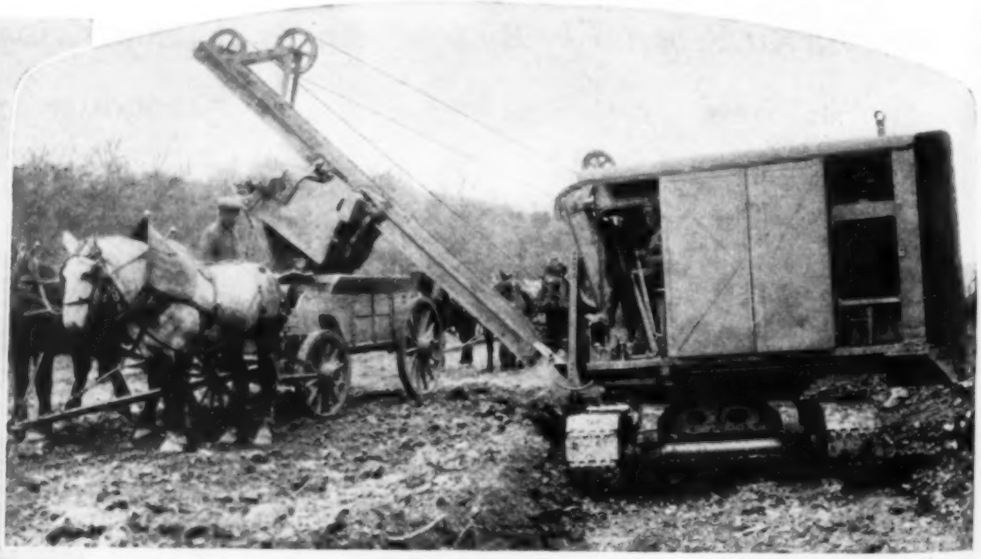


HARDPAN PLOW, with a pair of reversible teeth on 24-in. centers, makes cut 15 in. deep and 4 ft. wide. Heavy I-beam tongue for operation by tractor carries U-shaped floating axle and pair of wheels controlled by worm gear and cable device. Hand wheel at rear regulates depth of cut. When plow is in ground, wheels idle or float ahead. Plow weighs 3,000 lb. Hardened steel plow points are interchangeable. — Dukelow Hardpan Plow Co., 429 Michigan Ave., Joplin, Mo.



TRUCK MIXER for concrete has bladeless revolving drum with offset hexagonal heads, producing fore-and-aft slopes to triangular panels, so that mixture is shoveled back and forth and folded at corners of prism. Independent gasoline engine drive assures steady rotation of drum. Leakproof cam lock controls loading door. Discharge is through pair of butterfly doors, toggle-operated, allowing cutoff at will without spillage. Capacities, 1 to 5 cu.yd. Mounted on White truck.—Portland Concrete Machinery Co., 4519 Hamilton Ave., Cleveland, Ohio.

AGGREGATE AUTO GAGE is designed for correctly weighing sand and stone for concrete and compensating for moisture content after this factor has been determined for regular run of material. Device is intended to assure accurate water-cement ratio and correct proportion of cement to volume of concrete.—Toledo Scale Co., Toledo, Ohio.

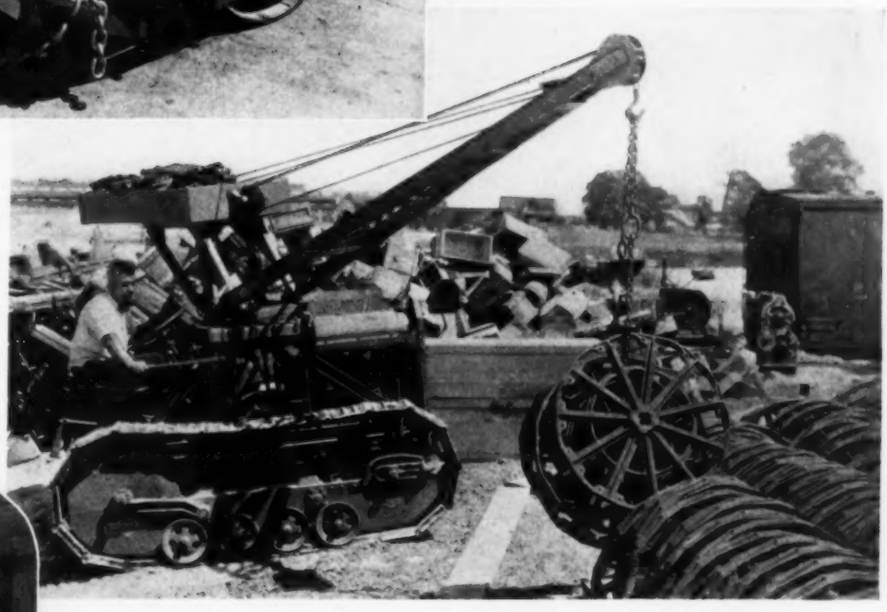


FULL REVOLVING SKIMMER, of 1-yd. capacity, is convertible into pull scoop, crane or dragline. Weight, 28 tons. Hold-down shoes tie upper structure to crawlers, giving stability needed for accurate control of skimmer bucket in grading streets. Weight of skimmer-ditcher boom, 2,500 lb. The 1-yd. skimmer bucket or 48-in. ditcher bucket also weighs about 2,500 lb. Light boom and bucket load make it possible to shorten tail swing to 8 ft. 6 in. For ditching, standard bucket sizes are 24 and 48 in. Power is supplied by 82-hp. Climax internal combustion engine. — Keystone Driller Co., Beaver Falls, Pa.

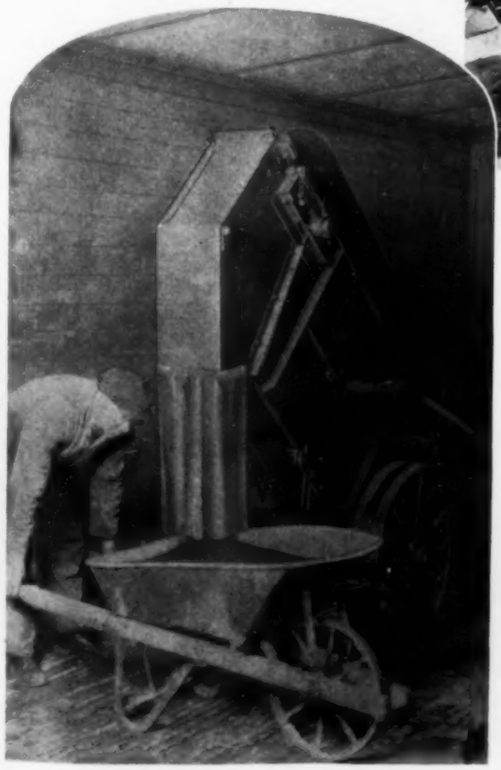
STAINLESS STEEL for Wire Rope

UNDER the name of Korodless, the Hazard Wire Rope Co., Wilkes-Barre, Pa., announces wire rope made of chrome-nickel stainless steel. Among its advantages is resistance to corrosion by acids, alkalis and salt water. It can also be used safely in temperatures up to 1,650 deg. F.

STONE SPREADER *(left)* for road building and maintenance, attached to rear end of motor trucks by chains, covers 8-ft. width. By means of a steel wire brush feed, regulated by tension device, depth of layer spread may be varied between 1 and 8 in. and mixed sizes of stone distributed uniformly. Weight, 2,600 lb. Revolving roll always travels on spread stone, not on soft subgrade of road. Machine, called the Handy Rol-Roc, is operated by one man. Wire brush feed prevents segregation of different sized stone. Width of spread may be varied by inserting plates to cover portion of machine which it is not desired to use.—Highway Service, Inc., New Bedford, Mass.

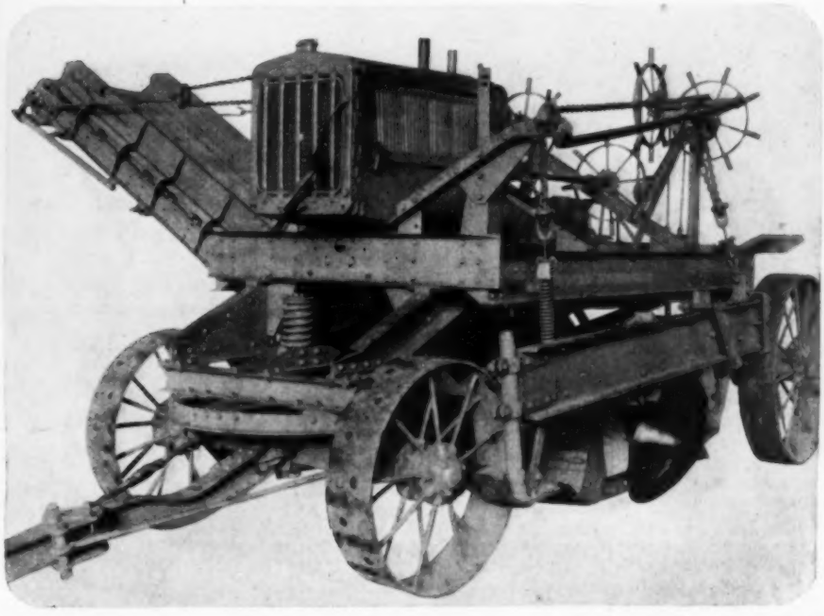


ROUSTABOUT CRANE *(right)* is adapted for use with Allis-Chalmers tractor equipped with Trackson crawlers. Machine is useful for laying pipe, setting poles, handling forms and unloading supplies and machinery. Boom, mounted on ball-bearing turntable, is full revolving and can be raised or lowered. Crane does not interfere with use of crawler tractor for haulage.—Hughes-Keenan Co., Mansfield, Ohio.



SMALL BUCKET LOADER, designed for operation inside of box car, handles bulk cement and other materials not exceeding 4 in. in size at rate of ¼ cu.yd. per minute. Loader is wheel-mounted, self-feeding and powered by 5-hp. enclosed electric motor. Pawl and ratchet feeding mechanism crowds machine into material to be loaded. Feed to buckets is by spiral ribbon. Bucket line housed to reduce dust. Discharge through cement chute. Dimensions: Height, 7 ft.; length, 6 ft. 9 in.; width, 4 ft.—Barber-Greene Co., Aurora, Ill.

ELEVATING GRADER *(below)*, with separate engine drive for carrier belt, is designed for operation by Caterpillar 60 tractor. Weight, complete, is 15,375 lb. Rear wheels have 8-ft. and front wheels, 6-ft. tread. Wheelbase, 13 ft.; overall length, 17 ft. Belt carrier length is 16-19 ft. for casts of 18 and 21 ft. Belt width, 42 in. Main shaft, with self-aligning coupling at front and self-aligning ball bearings at rear, is driven direct from crank shaft of 4-cylinder gasoline engine which delivers 25 hp. at the carrier belt. A 28-in. rigid disk plow is standard equipment, but rotary disk or moldboard plows are available.—Caterpillar Tractor Co., Peoria, Ill.



Present and Accounted For —

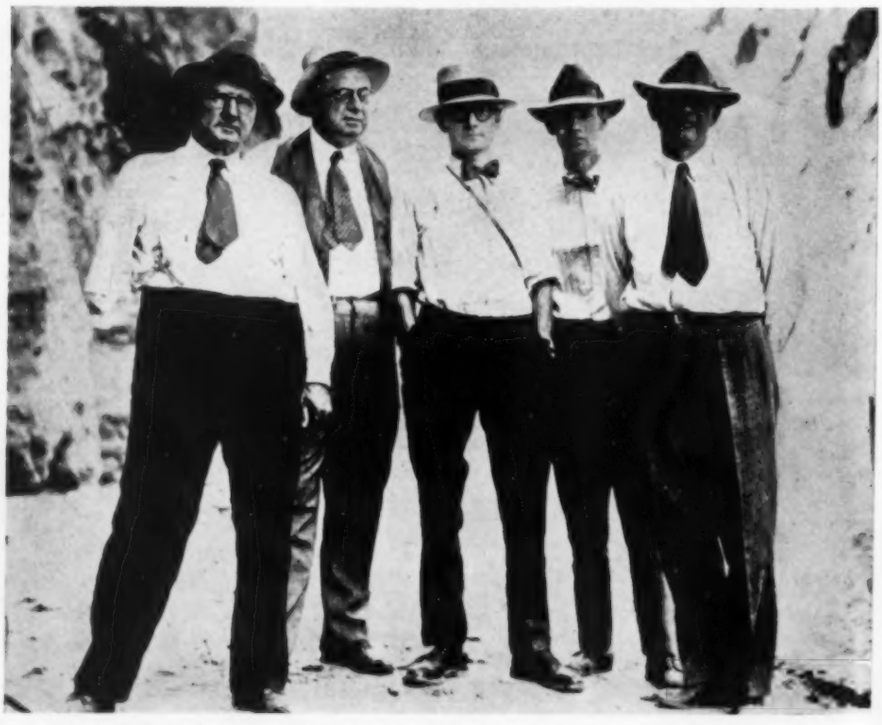
A Page of Personalities

SHE'S A REAL CONTRACTOR. Miss Julia Gallo, after an apprenticeship as bookkeeper, payroll clerk, estimator and supervisor with her father, James Gallo, general contractor, of Flushing, N. Y., bid in a job of her own—a concrete sewer in the Borough of Queens—and carried its construction to a successful completion.

HEADS HIGHWAY INDUSTRIES ASSOCIATION. Col. Willard Chevalier, publishing director of *Construction Methods*, is the newly elected president of the Manufacturers' Division of the American Road Builders' Association which he formerly served as treasurer.

ENGINEER A CIVIC LEADER. Robert Isham Randolph *(left)*, consulting engineer and scion of a noted engineering family, has been re-elected president of the Chicago Association of Commerce.

MISSOURI CONTRACTORS' PRESIDENT. J. L. Allhands, of Allhands & Davis, of Joplin, Mo., and Dallas, Tex., has been chosen head of the Associated General Contractors of Missouri.



ENGINEERING PERSONNEL FOR HOOVER DAM, all representatives of the U. S. Bureau of Reclamation on the Boulder Canyon project: *(Left to right)* Dr. Elwood Mead, Commissioner of Reclamation; R. F. Walter, chief engineer; Walker R. Young, construction engineer; John C. Page, office engineer; Ralph Lowry, principal assistant to construction engineer.

Universal TRUCK CRANE *Service!*

THE CHEAPEST AND QUICKEST WAY to get short crane jobs done, is with a Universal Truck Crane. You can buy one for steady service or rent one for temporary service from the Crane Service Rental Company located in your community.

Universal Crane Service Companies are located in major cities throughout the United States. They have machines ready for instant service at moderate rentals for—

loading and unloading cars
handling heavy or bulky materials
digging cellars and footings
ditch digging
pile driving
steel erecting
culvert building
pipe laying
and 101 short crane jobs.

Look up your nearest Universal Crane service rental man—he can save you money on practically any job—and surprise you with the speed his Motor Truck Universal will show getting to the job.

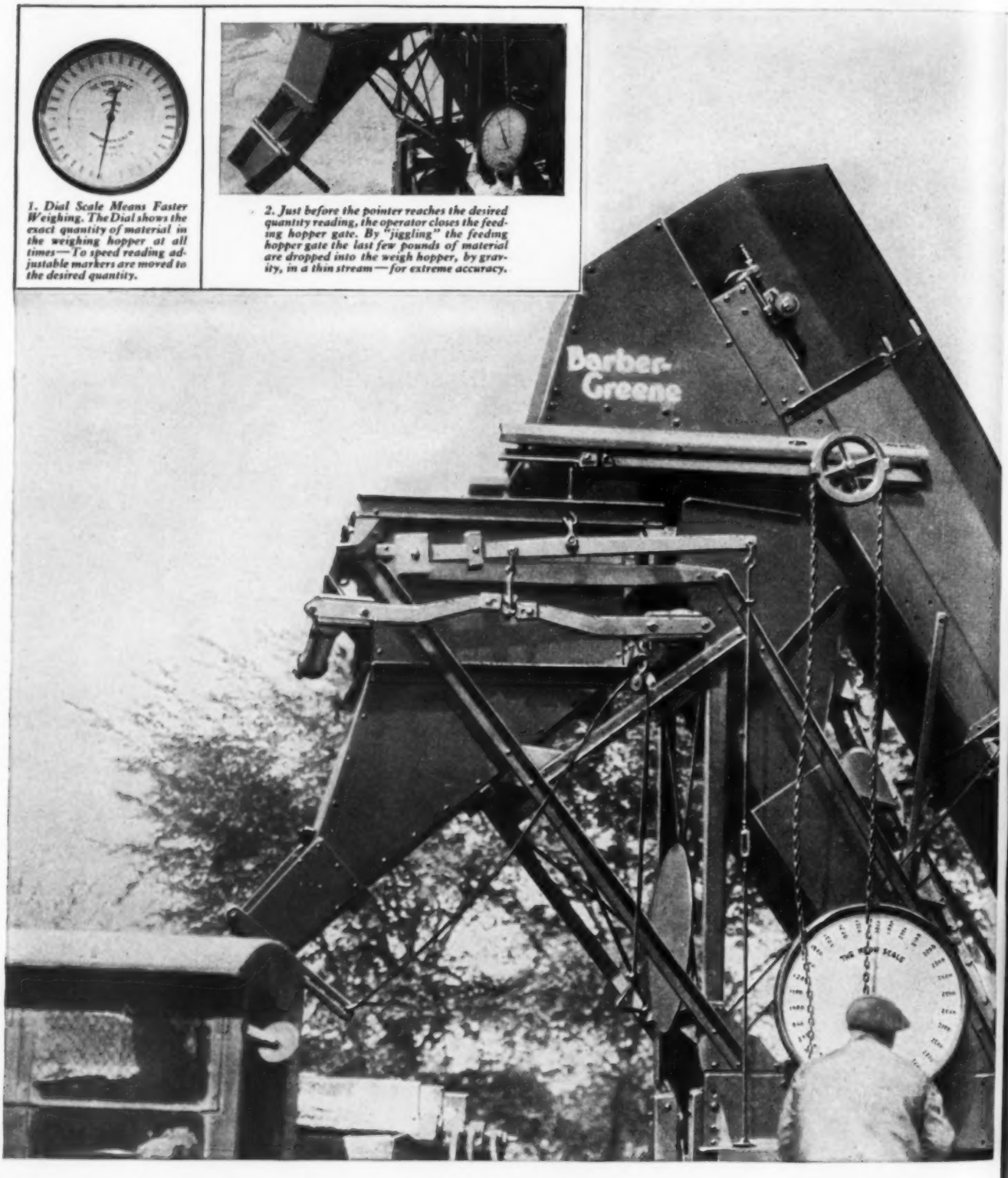
THE UNIVERSAL CRANE COMPANY
LORAIN, OHIO

UNIVERSAL

Specializing in Inventing Faster, Cheaper Machines

1. Dial Scale Means Faster Weighing. The Dial shows the exact quantity of material in the weighing hopper at all times — To speed reading adjustable markers are moved to the desired quantity.

2. Just before the pointer reaches the desired quantity reading, the operator closes the feeding hopper gate. By "jiggling" the feeding hopper gate the last few pounds of material are dropped into the weigh hopper, by gravity, in a thin stream — for extreme accuracy.



BARBER GRE

STANDARDIZED MATERIAL HANDLING MACHINES

530 West Park Avenue Auro

Weighing Out Pavement . . . Before Your Eyes

« « « A New Barber-Greene Loading and Batching Tool

The New Barber-Greene Kron Dial-Scale Weighing Hopper brings to contractors:

—all the high-speed, low investment, aggregate loading of Disc-Feed Barber-Greene Loaders plus:

—a sensitive, fool-proof, visual weighing of aggregates.

There are no springs in the assembly, no weights to juggle. The actual quantity of material in the weigh hopper, at all times, is faithfully registered, from zero to capacity, by the easily read dial.

Visual Accuracy

The shocks of pouring aggregates into the weighing hopper do not affect the Dial's accuracy. A dash-pot—or in effect a hydraulic shock absorber—sees to it that the dial needle swings surely and steadily, without flickering, to the exact figure.

Extremely sensitive balance is obtained through the use of knife-edge bearings—the most accurate scale bearing obtainable. Dust and dirt cannot affect the accuracy of such bearings.

Through special design, the load is always held directly on the knife edge, preventing excessive wear on the bearing and eliminating the danger of twisting strains.

Floating Hopper

The weighing hopper rides as independently of the loader frame as human engineering can make it. Accuracy is not materially affected by the movements and vibrations of the loader.

To provide fractional pound control a small feeding hopper with a fast-acting cut-off gate, is located above the weighing hopper. As the dial needle approaches the marked amount, the operator closes the gate and "jiggles" the material into the weigh hopper with the feeding gate, for close accuracy.

A Low Cost Tool

With this new, accurate, sturdy weighing hopper the Barber-Greene "62" Loader gives the Paving Contractor a new low-cost loading and weigh-batching tool that can save many thousands of dollars in aggregate handling and batching equipment—a tool that keeps the fastest 27-E stepping at top speed all day long. Ask for Bulletin.

REENE

Aurora, Illinois

Standardized Belt Conveyors Portable Belt Conveyors
Portable and Self-propelled Flight Conveyors
Self-propelled, Self-feeding Bucket Loaders
Flight and Belt Car Unloaders Snow Loaders

■ Like the nose of a swift battleship cleaving water, the Wehr blade rolls out the heavy rock-filled earth. The footing is loose and slippery, but it's easy sailing for the Wehr, with its gripping traction and full power at the blade!

You can set the blade deep and cut wide with a Wehr Grader on the job. See how the Model "A" is levelling off new fill-in dirt to make a new highway. In any kind of soil, in any kind of weather, the Wehr can be relied upon to do its full share of heavy work.

Wehr Graders offer distinct advantages that assure economical and dependable service to road builders. Built by the originators of the one-man power grader, Wehr machines have stood the test of time and service on the highways of the world.

Write today for further details on Wehr construction graders.

. . . but easy sailing for the **WEHR**

WEHR COMPANY

MILWAUKEE, WIS. **FACTORY: CUDAHY, WIS.**

WEHR

ROAD BUILDING AND MAINTENANCE EQUIPMENT

MULTI FOOTE

YOU wouldn't expect more—with our 1931 refinements in design, in materials, in speed—

MORE PROFITS

will come out of this new MultiFoote mixer than have ever been possible from any road paver. Don't be satisfied with less—get the facts.

MULTIFOOTE DISTRIBUTORS

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NEW YORK CITY
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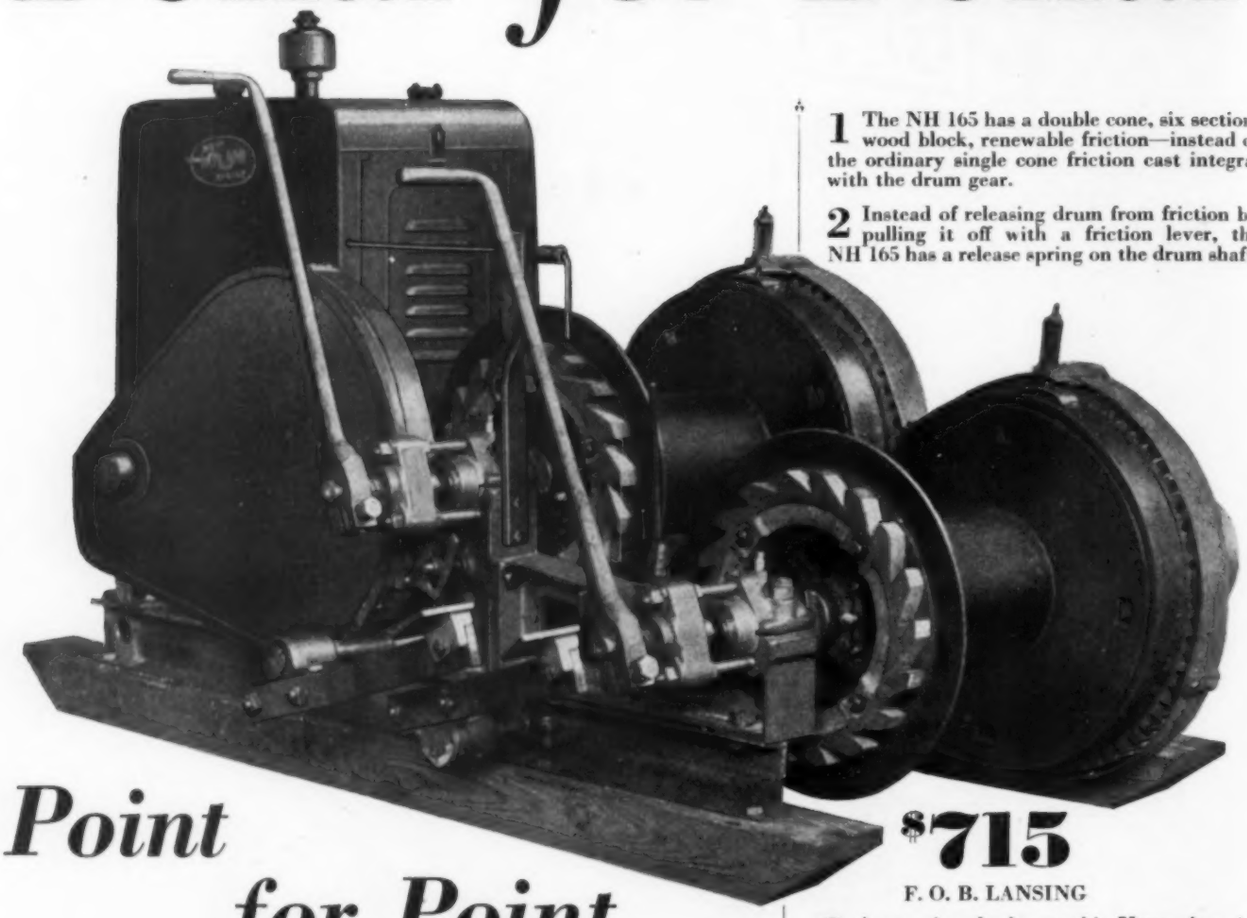
London Concrete Machinery Co.

THE FOOTE COMPANY, INC., OF NUNDA, N. Y.

• • World's Largest Exclusive Builders of Road Pavers • •

Dollar *for* Dollar



Point for Point

Match this NovoNH 165 double drum hoist—with 4-cylinder Timken Roller Bearing equipped engine—against any other machine in its field.

Work it long hours. Load it up. It's built for speed, rapid acceleration, fast braking, over-strength and the utmost in dependability.

To the right are shown a few of the reasons why the Novo NH 165 stands out so far ahead of competition. The coupon will bring you the new folder giving complete details. Send it today.

NOVO ENGINE COMPANY
214 Porter Street, Lansing, Mich.
Clarence E. Bement,
Vice - President and General Manager

NOVO
PUMPS—ENGINES—HOISTS

Please send me complete details on the NH 165 double drum hoist.

Name..... *Address*.....

City..... *State*.....

Company.....

1 The NH 165 has a double cone, six section, wood block, renewable friction—instead of the ordinary single cone friction cast integral with the drum gear.

2 Instead of releasing drum from friction by pulling it off with a friction lever, the NH 165 has a release spring on the drum shaft.

$715
F. O. B. LANSING

3 A one-piece brake on this Novo gives ½ more braking and a far more effective braking action than the two-piece brakes usually need.

4 The ratchet is bolted to the drum and can easily be replaced if broken. On others, the ratchet is cast integral with the drum.

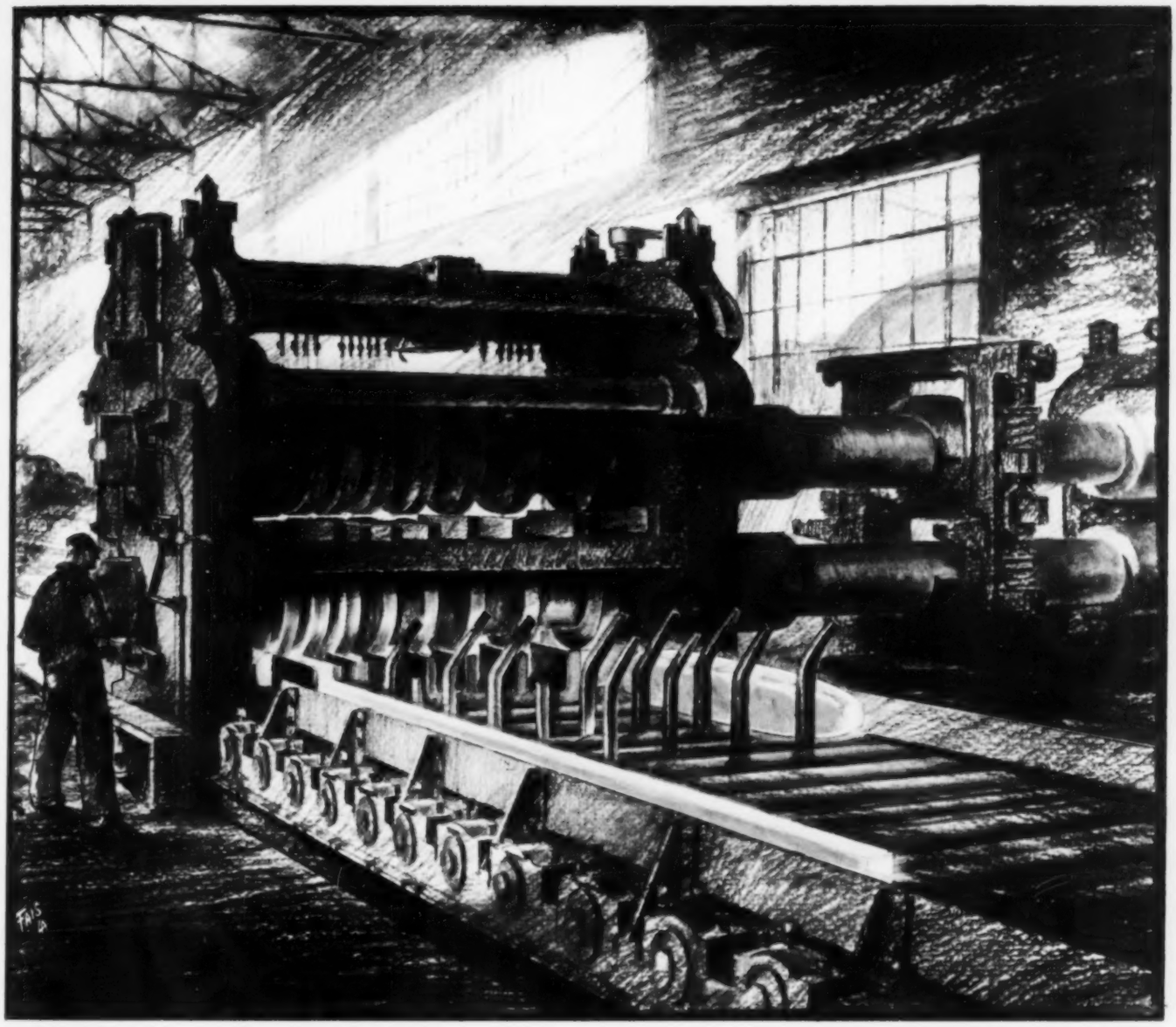
5 Drum shaft bearings are of pillow block construction with stud bolts—instead of flat cap bearings with through machine bolts.

6 The pawl and brake shafts are separate on the NH 165. On others, where the pawl or dog is mounted on the brake shaft, the brake is absolutely useless when the pawl is engaged. This means that when a load is suspended in midair, and held there by the pawl, accidentally jarring the foot brake can throw the pawl out.

7 The NH 165 has a real screw thrust—not a cam thrust.

8 The side frames are separate from the base. And the base is of welded steel construction with tubular spreaders to maintain alignment and give additional strength. This is far superior to having the side frames and base all in one piece—and depending on wood skids for alignment.

9 A Novo four-cylinder, anti-friction engine, with Timken Roller Bearings on crankshaft and driveshaft, supplies the power. Vibration is virtually eliminated. Horsepower is increased. Gas consumption is less. And operation is extremely smooth and dependable. Extended hand throttle convenient for operator.

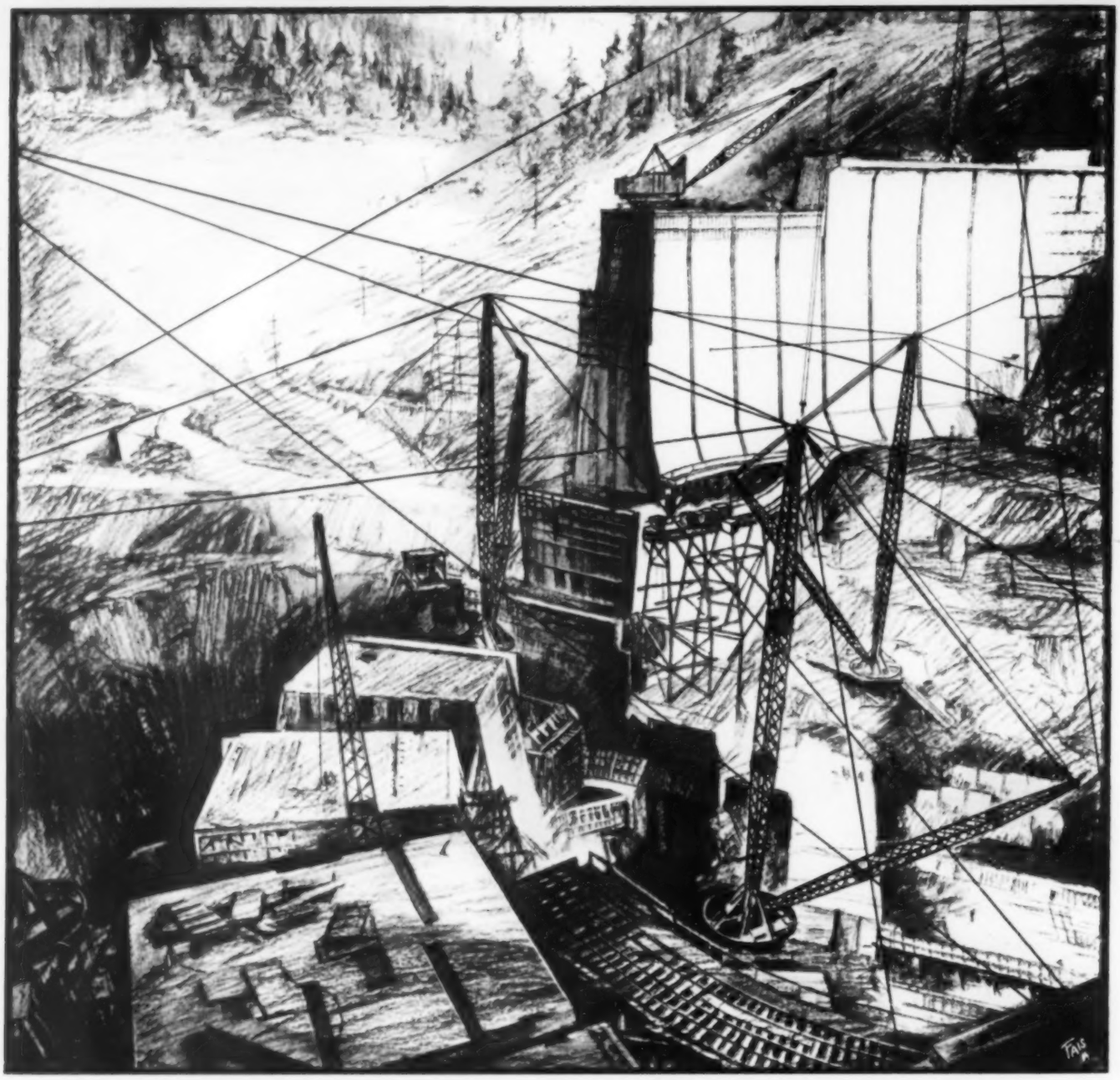


Hungry jaws *knead* the glowing ingot

FIERY RED, an ingot of steel glides up the rollway. Then cruel jaws seize the glowing mass and mold it...back and forth...like so much incandescent putty. Fourteen inches wide, sixteen inches deep and five feet long, when it enters this mill...it leaves a slender "bloom," four inches by four and seventy feet long.

Follow a "bloom" of Roebling acid open-hearth steel and you will understand the exceptional safety and stamina of Roebling "Blue Center" Steel Wire Rope. As it passes through a seemingly endless chain of processes, each step of production is marked by painstaking thoroughness. The technique of every operation is the result of over 90 years of experience.

ROEBLING "BLUE CENTER" STEEL **WIRE ROPE**



Ariel Dam and Powerhouse on Lewis River, near the town of Ariel, Washington. Under construction by the Phoenix Utility Company for the Inland Power and Light Co. Will eventually be operated under lease by Northwestern Electric Co., Portland, Ore.

ROEBLING . . . *at the great Ariel Dam*

WELL under way, on the Lewis River near the town of Ariel in Washington, is one of the biggest hydro-electric projects on the entire west coast. It is the great Ariel Dam and powerhouse under construction by the Phoenix Utility Company.

In building this dam it was necessary to excavate to a depth of over 100 feet below the bed of the river. Excavated yardage for dam and powerhouse foundations, and diversion tunnel, amounts to 350,000 cubic yards. When completed, the dam will impound the river to form a 4000 acre lake with a 35 mile shore line. On a project such as this, the selection of wire rope for derricks and other excavating machinery is naturally an important procedure. Many thousands of feet are needed and it is an economy to use a rope of unquestioned stamina. That practically all of the wire rope used at the Ariel Dam is of Roebling manufacture is a significant fact.

JOHN A. ROEBLING'S SONS COMPANY

WIRE...WIRE ROPE...WELDING WIRE...FLAT WIRE
COPPER *and* INSULATED WIRES AND CABLES
WIRE CLOTH AND WIRE NETTING

TRENTON, N.J. *Branches in Principal Cities*

ROEBLING **WIRE ROPE**

"BLUE CENTER" STEEL

In California—It's AUSTIN

Austin Trencher with double row of buckets excavating 300 lineal feet of 80 inch by 9½ feet deep trench per day in Los Angeles. Charles H. Johnston, contractor.

STORM DITCH
Dug By
HUGE TRENCHER

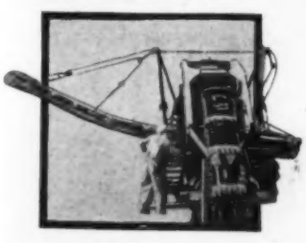
Construction Methods says in its February issue, "to accommodate precast concrete pipe from 54 to 69 inches in diameter for the Jefferson No. 3 storm drain in Los Angeles, California, Charles H. Johnston, contractor of that city, employed a trench excavator of exceptional size and capacity to dig a ditch averaging 80 inches wide and 9½ feet deep. The machine, an AUSTIN unit—was powered by a 125 hp. six cylinder gasoline engine.

"Average progress was 300 feet of trench per day.—Feature of the job was close coordination of the pipe laying, jointing and backfill operations.—Close sequence of operations involving a distance of only 250 feet between the trenching machine and the backfiller enabled the contractor to open up a minimum length of street and quickly restore the surface, thus interfering only slightly with the movement of traffic."

Austin trenchers are made in a complete range of sizes. The new and improved Austin crane, clamshell, dragline, shovel, hoe, will handle ⅜ to ½ yard capacity dipper or bucket. Handles heavy loads and like all Austin machines is simple, economical and dependable. Austin team play on any job is the surest and quickest way to final and profitable estimates. Catalogs on request.

AUSTIN

TRENCHERS · CRANES · BACKFILLERS



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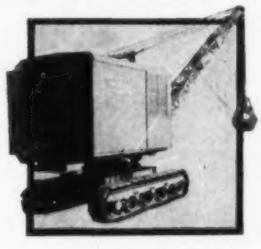
MUSKEGON MICHIGAN

District Offices:—Newark, N. J., 326 Frelinghuysen Ave. Cleveland, Ohio, 1943 W. 100th St. Toledo, Ohio, Canterbury Court, Ottawa Hills. Chicago, Illinois, 315 Railway Exchange Bldg. St. Louis, Mo., 1504 No. Broadway. Dallas, Texas, 209½ N. Clinton St. Los Angeles, Calif., 2411 E. 26th St., H. C. Collins Co. Toronto, 3 Ontario, Canada, 17 Waller Ave.

Representatives in most principal cities throughout U. S. A. and Canada



PUT SPEED

Cletrac Crawlers are built in a complete line of tractor sizes with a range of horsepower delivery from fifteen to a maximum of eighty. Five sizes.

SPEED is a factor on every job. It brings down costs and gears up the working schedule to a point of real efficiency.

With the heavy work about to start why not meet it with equipment that's RIGHT — that can put speed and economy into every job and crowd more jobs into the season.

Cletrac Crawlers are built exactly for this kind of performance — *to make work move faster and cost less.* They are powerful, dependable units that team up well with any kind of equipment on any type of work. Down in the mud of a levee-building job or on the surface of a highway their sure

CLETRAC

INTO YOUR 1931 SPRING WORK

tread and uncompromising power make them equally effective — a sure match for big loads and hard pulls.

Whether you need the quick, mobile power of the small Cletrac "15" for a light job or want intermediate or giant power for heavier operations you can match your requirements with one or more of the five Cletrac sizes. With bulldozer, scraper or scoop train—with massive dirt wagons or elevating graders—there's a Cletrac Crawler to fit both the equipment and the demands of the job.

THE CLEVELAND TRACTOR COMPANY
19323 Euclid Avenue Cleveland, Ohio

See the Cletrac dealer for a demonstration or write direct for full information on any or all models.

CRAWLERS

TRY TO DO IT CHEAPER

HERE'S a "Caterpillar" Fifteen on which is mounted a Miami Loader. The outfit is stripping top soil for greenhouse use. It goes after dirt in softest places and brings it back to the truck. It scrapes up the soft humus skilfully and handles a yardage that pares costs to the bone. "Caterpillar" Tractors can be equipped with all manner of new equipment for speeding up earth-moving—loaders, automatic scrapers, compressors, augers, and other labor- and time-saving devices. How can you use a "Caterpillar" to increase your profits?

Prices—f. o. b. Peoria, Illinois

TEN . . .	$1100	TWENTY .	$1900
FIFTEEN .	$1450	THIRTY .	$2375
SIXTY	$4175		

Caterpillar Tractor Co.

PEORIA, ILLINOIS, U. S. A.

Track-type Tractors Combines Road Machinery

(There's a "Caterpillar Dealer Near You)

CATERPILLAR
REG. U.S. PAT. OFF.
TRACTOR

BIGGS ELECTRICALLY WELDED STEEL PIPE

The City of Cleveland installs an additional 10,000 feet of 48-inch diameter Biggs Electrically Welded Steel Pipe on the Ingersoll Road High Service Main. The Joseph Winterbottom Company, Cleveland, Ohio, were the contractors.

WHEN the next pipe line job comes up in your territory, why not work with Biggs? Note what Mr. Joseph Winterbottom says about the above job:

"Everything went along smoothly on the fitting of the pipe in the field. As you know, the specifications called for *water-tight joints* under a test of 175 pounds. The pipe withstood this test 100 per cent, we experiencing no leakage whatever in connection with your shop work, in fact experiencing no trouble of any kind.

"Our pipe-laying gang commented several times upon the attention you evidently gave to small matters, for the special sections fitted very accurately and the whole job was laid with a minimum amount of labor."

Biggs pipe and Biggs service have called forth expressions like this in connection with major water works projects all over the United States—in New York City, Boston, Detroit, Kansas City, and elsewhere. Without exception, they point to the low cost of installation made possible by accurate, deft fabrication—by a plant specifically equipped for pipe work—by Biggs' long years of down-in-the-ditch acquaintance with contractors' problems.

Why not let Biggs furnish the pipe for your next project?

Important Advantages of Biggs Welded Pipe

Water works engineers everywhere are placing more and more steel pipe in the ground each year because of: 1. Its dependability. 2. Its long life. 3. Its superior structural strength and ductility over all other types. 4. Its low first cost and maintenance. 5. The continuity of service and freedom from rupture which it assures.

Biggs Builds:

The same close and accurate attention to detail runs through all products built by Biggs, notably:

Welded Steel Pipe	Pontoons
Riveted Steel Pipe	Air Locks
Tunnel Shields	Welded Tanks
Caissons	Riveted Tanks

General Steel Plate Work

THE BIGGS BOILER WORKS COMPANY

New York AKRON, OHIO Detroit

BIGGS Steel Pipe *Riveted and Welded*

BOILER WORKS The Biggs CO. EST 1867 AKRON OHIO

More holes to the blast.. Fewer misfires!

A number of the features from the No. 5 G. M. machine have been incorporated in the du Pont No. 2 and No. 3 Blasting Machines. These machines are now being manufactured with a two-point clutch, an eight-point breaker switch and a condenser. These improved machines materially reduce the chances of misfires in thirty- and fifty-hole shots.

with these new *and* improved BLASTING MACHINES

Developed by General Motors for du Pont, these new blasting machines are now offered to save you money in blasting operations!

The NEW du Pont No. 5 Blasting Machine . . . known as the No. 5 G. M.—because it was designed by General Motors . . . has proved highly successful in many blasting operations where it is necessary to fire a large number of holes at one time.

Here are the special new features that will recommend No. 5 G. M. to you:

(1) A two-point clutch which makes it possible to send the current out on the firing line at its peak.
(2) A laminated armature and solid core field for building up the maximum current.
(3) A one microfarad condenser to store up the current until the moment of discharge.
(4) Most important of all, a new eight-point breaker of unique design which utilizes the current heretofore wasted as a large spark at the completion of the stroke.

Field windings on the new machine are so placed as to increase its efficiency. There are ball bearings on the armature shaft; and a thrust bearing for the rack bar in the direct line of the thrust instead of offset as formerly.

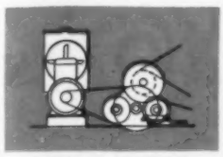
The new machine has a rated capacity of 100 electric blasting caps. As a matter of fact, it has often fired as many as 125 holes connected in series. The weight of this machine is a little less than 36 pounds.

In quarry and construction work, No. 5 G. M. has proved particularly useful. Its large volume of current at sufficient voltage reduces the chances of misfires from electric leakage.

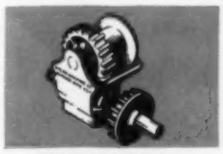
E. I. DU PONT DE NEMOURS & CO., INC.
Explosives Department
WILMINGTON, DELAWARE

DU PONT
REG. U. S. PAT. OFF.

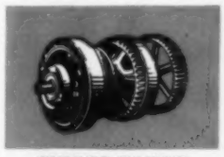
This "full grown" shovel weighs only ten tons complete



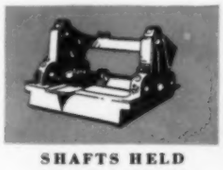
DIRECT POWER SAVING DRIVE



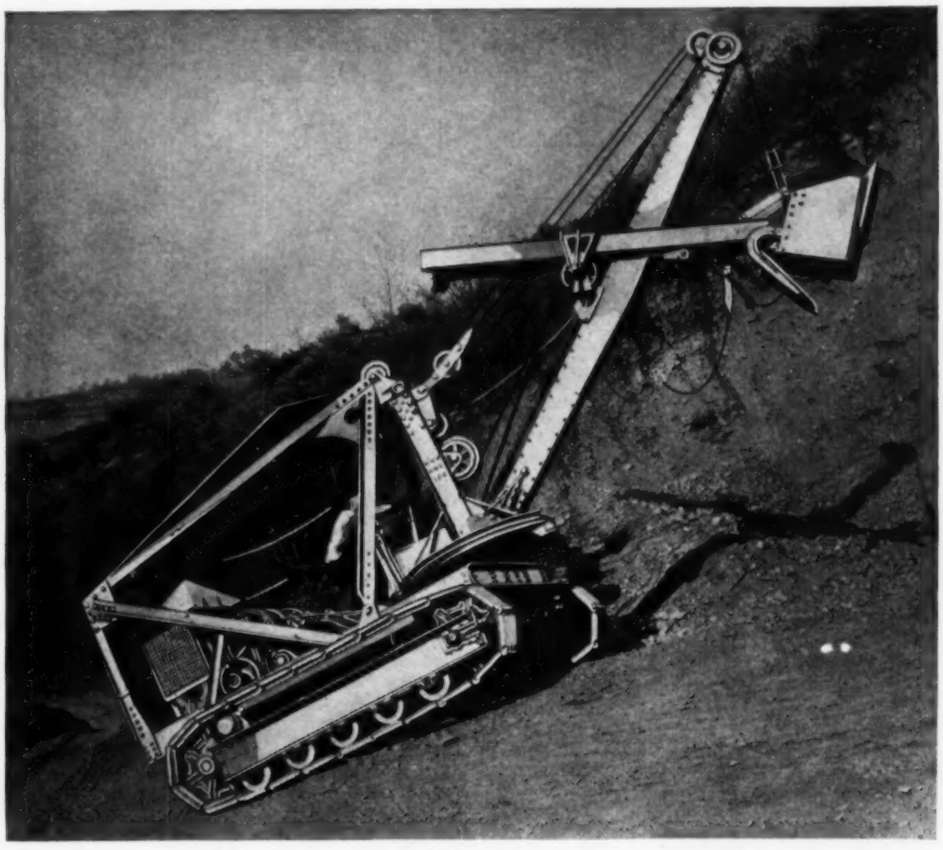
WORM DRIVEN BOOM HOIST

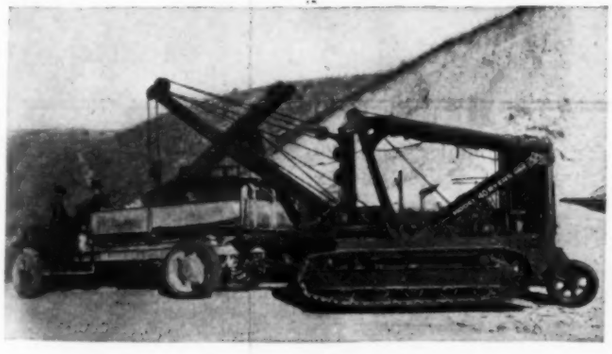


FINGER TOUCH CLUTCHES



SHAFTS HELD IN CAST FRAME





Full Grown **with finest engineering and construction features of Byers 1 yard Shovels.**

Weight 10 Tons Complete **which allows travelling over small country bridges.**

Powerful Motor, **easily propels Byers Excavator up 40% grades.**

Patented Independent Cable Crowd **cuts long smooth grade, dumps sticky materials quickly.**

Job Profits Are Larger **because of low maintenance cost.**

Byers Patented Trailer **is the most compact and economical trailer on the market. Amply strong and rugged to carry this 10 ton machine over rough pavements and along highways behind a truck AT MOTOR TRUCK SPEEDS.**

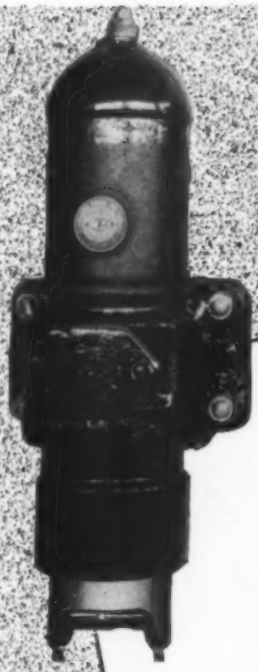
Write today for full information

THE BYERS EXCAVATOR CO., RAVENNA, OHIO

BYERS EXCAVATORS

Patents Pending on Excavator and Trailer

PRACTICE THAT PROVES THE THEORY OF AIR SPRINGS



GASOLENE LUBRICATING OILS AND GREASES

PARAGON MOTOR OIL

The Paragon Refining Co.
TOLEDO, OHIO.

March 4th, 1930

The Cleveland Pneumatic Tool Co.
Cleveland, Ohio

Gentlemen:-

In checking over some comparative maintenance cost sheets we discovered something that should be of interest to you as it relates to GRUSS AIR SPRINGS.

Our figures show a saving of approximately $200.00 per year on each truck equipped with Air Springs against the same Model and Type of truck when not equipped.

This matter was brought to our attention recently when checking into some equipment taken over with the acquisition of another Oil Company. Out of eight trucks brought in, seven of them had broken frames. The only one with frame in perfect condition was equipped with your Air Springs. And the general condition of this one truck was far better and required less expense to overhaul.

We believe that whether you use solid or pneumatic truck tires we save enough each year to pay for the original cost of Gruss equipment.

Yours very truly,

THE PARAGON REFINING COMPANY

Per Edward Ridley

Supt. Motor Transportation

The above letter is a typical expression from truck operators using Cleco-Gruss Air Springs and who have kept accurate maintenance cost records.

In addition to the dollars and cents saving in maintenance, Air Springs improve driver morale, speed up hauling time and keep the jobs on the road instead of in the shop.

Find out today what it would cost you to equip your trucks with Cleco-Gruss Air Springs.

CLECO AUTOMOTIVE PRODUCTS

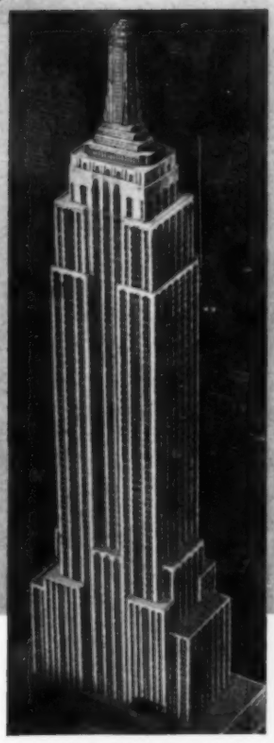
MANUFACTURED BY THE CLEVELAND PNEUMATIC TOOL CO., CLEVELAND, OHIO

Ransome

Four 28-S, one 21-S and one 7-S Ransome Mixers helped build the Holland Vehicular Tunnel between New York and New Jersey.

Four 56-S Ransome Mixers were selected for the Safe Harbor Dam job, approximately one mile long and 65 feet high.

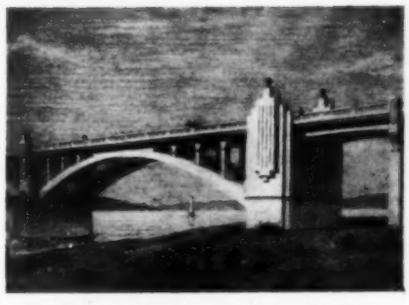
One Ransome 56-S Mixer was used to pour 105,000 cu. yds. of concrete in the construction of the Suisun Bay Bridge, Cal.



Two Ransome 21-S Mixers helped build the tallest building in the world—Empire State Building, New York City

Ransome Mixers, Tower and Chuting Equipment helped build the world's largest auditorium, Atlantic City, N. J.

BIG MIXERS *for* BIG JOBS



Two 28-S Ransome Mixers were used on the Susquehanna River Bridge, the largest multiple arch concrete highway bridge in the world.

Wherever there's an outstanding construction job you are apt to find Ransome equipment in use.

Write for Bulletin No. 122

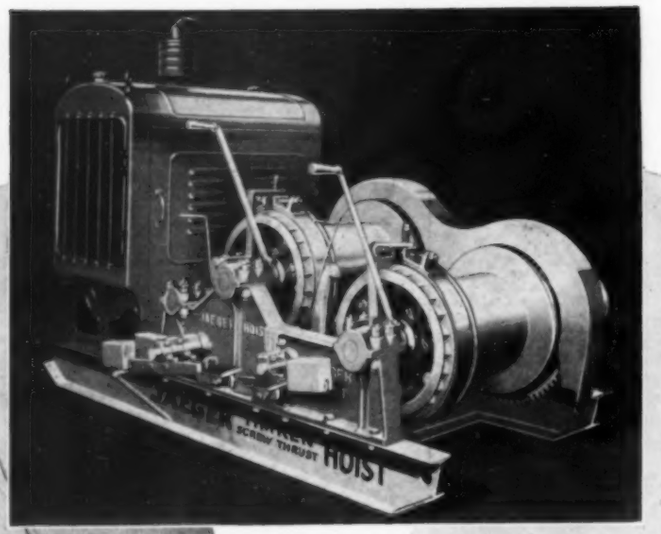
It tells about Ransome Big Mixers

Ransome Concrete Machinery Company

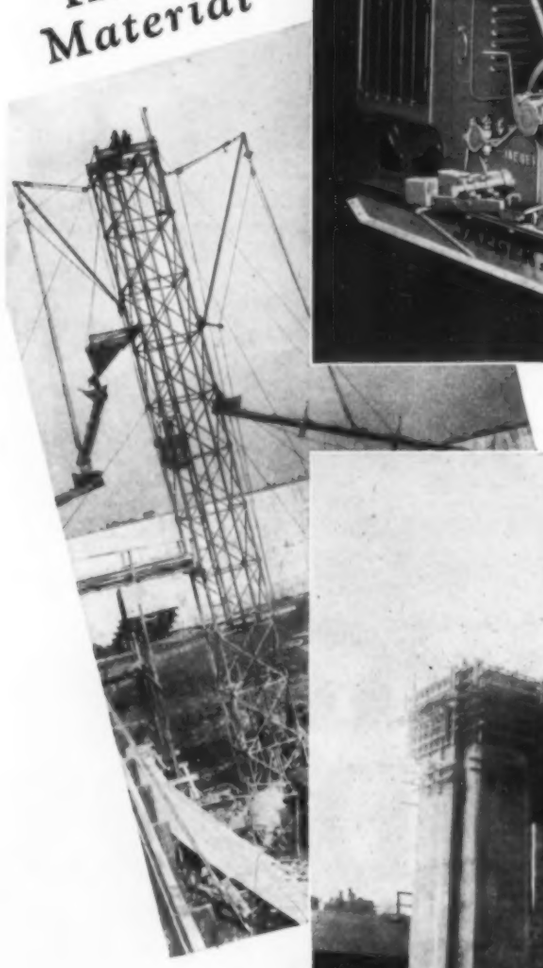
1850—Service for 81 Years—1931

Dunellen **New Jersey**

Hoists Material



Places Concrete



JAEGER-LAKEWOOD
Does the WHOLE Job . . . . on ANY Job

TIMKEN SCREW THRUST HOISTS
Combine the features you've always liked about a hoist with new features that you've always wanted. Handle your hoisting operations faster, with greater safety and easier control. Single and double drum types (convertible), with gas or electric drive, for big jobs and small. Our 1931 prices are real news.

TOWERS, MAST PLANTS, CHUTING
The most complete line of its kind, designed to handle materials and place concrete at lowest cost, on every size and type of job. Towers with outside bucket do two jobs at once. Jaeger-Lakewood half-round, arch-band Chute handles dry concrete easier in any volume. Write for details.

Send for Catalogs...1931 Prices!

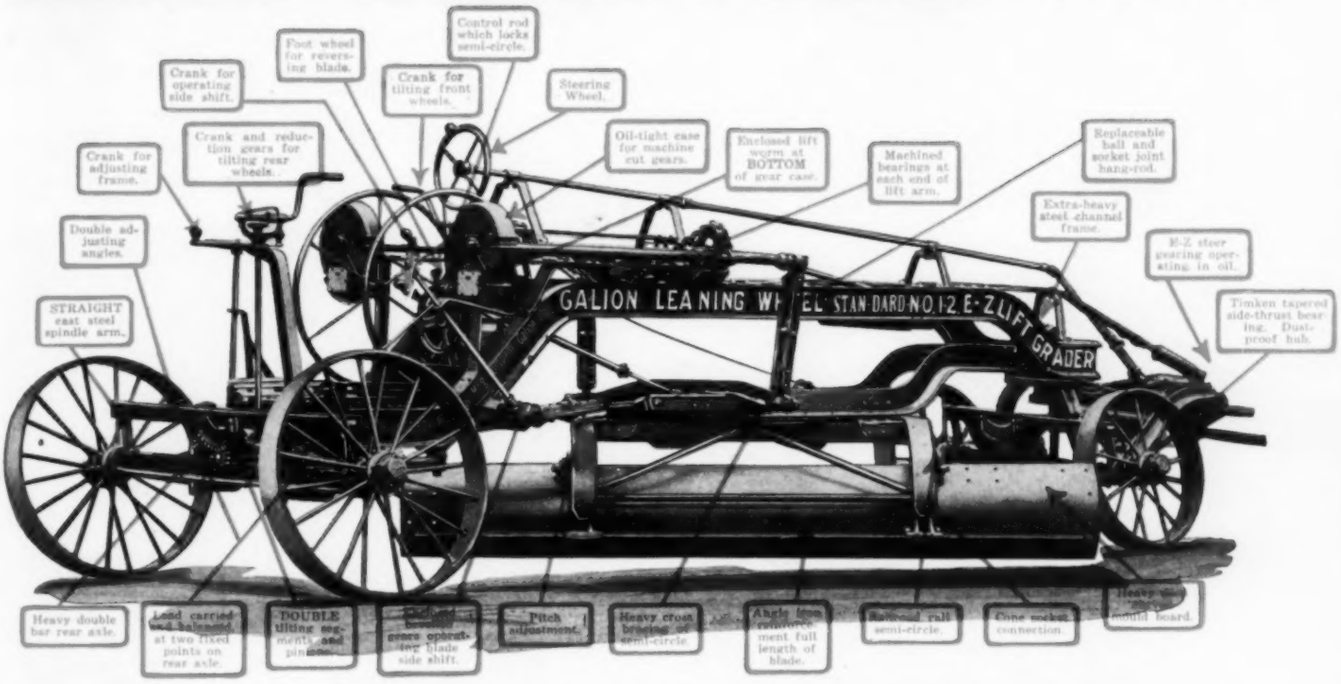
THE JAEGER MACHINE CO., 800 Dublin Ave., Columbus, O.

Send latest catalog and prices on [ ] Jaeger-Lakewood Material Towers, [ ] Placing Equipment [ ] Jaeger Timken Thrust Hoists.

Name _____

Address _____

these FEATURES . . . .


Control rod which locks semi-circle.
Foot wheel for reversing blade.
Crank for operating side shift.
Crank for tilting front wheels.
Steering Wheel.
Crank and reduction gears for tilting rear wheels.
Oil-tight case for machine cut gears.
Enclosed lift worm at BOTTOM of gear case.
Machined bearings at each end of lift arm.
Replaceable ball and socket joint hang-rod.
Crank for adjusting frame.
Extra-heavy steel channel frame.
Double adjusting angles.
E-Z steer gearing operating in oil.
STRAIGHT cast steel spindle arm.
GALION LEANING WHEEL STANDARD NO. 12 E-Z LIFT GRADER
Timken tapered side-thrust bearing. Dust-proof hub.
Heavy double bar rear axle.
Load carried and balanced at two fixed points on rear axle.
DOUBLE tilting segments and pinions.
Pitch adjustment.
Heavy cross bracing of semi-circle
Angle iron reinforcement full length of blade.
Reinforced rail semi-circle.
Cone socket connection.
Heavy moldboard.

tell you Why GALION Graders Are Better . . .

Galion Distributors

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O. B. Avery Co., St. Louis, Mo.
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Eastern Trac. Co., Portland, Me.—Cambridge, Mass.
Feenaughty Machy. Co., Portland, Ore.
Frankfort Equip. Co., Frankfort, Ky.
Good Roads Machy. Co. of N. Y., Inc., New York.
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Herd Equipment Co., Oklahoma City, Okla.
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Jeffrey Mfg. Co., Ltd., Montreal, Que.
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C. H. Jones Co., Salt Lake City, Utah.
Lewis-Patten Co., San Antonio, Texas.
Lewis Tractor & Machinery Co., Fargo, N. D.
Louisiana Road Machy. Co., New Orleans, La.
R. L. McDonald Equip. Co., Springfield, Mo.
Miller & Requarth, Springfield, Ill.
H. W. Moore Equipment Co., Denver, Colo.
Morrow Auto Co., Albuquerque, N. M.
Murphy & Murphy, Little Rock, Ark.
North Carolina Equip. Co., Raleigh, N. C.
Northfield Iron Co., Northfield, Minn.
G. C. Phillips Tractor Co., Inc., Birmingham, Ala.
Power Equip. & Service Co., New Haven, Conn.
Richmond Machy. & Equip. Co., Richmond, Va.
F. Ronstadt Co., Tucson, Ariz.
Salina Tractor & Thresher Co., Salina, Kan.
Bert Smith, Enid, Okla.
Smith-Booth-Usher Co., Los Angeles, Cal.
Standard Road Equip. Co., Rockford, Ill.
W. H. Stoutenburg, Penn Yan, N. Y.
Tennessee Tractor Co., Nashville, Tenn.
F. E. Vaughn, La Crosse, Kan.
Welch Good Roads Supply Co., Welch, W. Va.

Check over the features of construction and operation of Galion Leaning Wheel Graders in the illustration above. Every practical feature found in any other Leaning Wheel Grader is there,

PLUS the Galion Automatic Skew Axle — an exclusive development that assists the leaning wheels in holding the moldboard to heavy work.

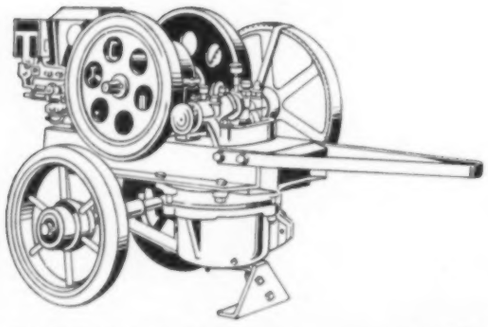
PLUS the Galion E-Z Lift method of control — the easiest means of control ever devised for operating Leaning Wheel Graders.

PLUS the Galion high standard of construction which insures rigidity under all working strains.

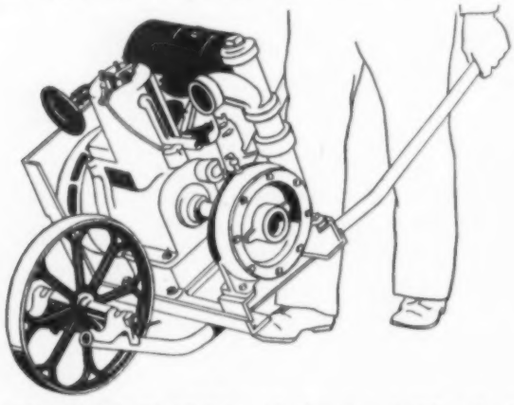
Nine sizes, with moldboards ranging from 7 ft. to 14 ft., provide a size for every job and every power from horses to the largest tractor.

Descriptive bulletin giving complete information will be sent upon request, without obligation.

The Galion Iron Works & Mfg. Co.
GALION, OHIO . . . . . .



REX 3" DIAPHRAGM—Another super value on a new idea—Weighs but 525 lbs., that's 250 below the average—Measures but 30" high, 29" wide, 42" long—But handles 6500 g.p.h. on 7' lift at sea level—The only 3" pump with famous 9-minute diaphragm change—1½ h.p. engine—Long-life diaphragm—Price with steel wheels, only $175.00 f.o.b. Milwaukee.



REX WATER BOY—World's lightweight champion—A 2" Centrifugal with ball bearing impeller—Only 23" wide—Weighs but 300 lbs.—Mounted for one-man handling anywhere—Maximum capacity 9300 g.p.h.—Will handle heads up to 50 ft.—1½ h.p. self-oiling, air-cooled engine—But price is only $170.00 f.o.b. Milwaukee.

REX No. 3 SAW RIG—Home Builders' Special—Only 28" wide—wheel-mounted—45 degree tilting table—Improved saw guard—Handles dadoing, mitering, beveling, double-mitering, etc.—3 h.p. self-oiling engine, radiator cooled—Electric motor if desired—Blade cuts off in straight line—no arc. With gasoline engine, $275.00 f.o.b. Milwaukee.

REX
CONSTRUCTION EQUIPMENT

REX Mixers—Pumps—Saw Rigs—Plaster and Mortar Mixers—Pavers—Complete Concrete Factories—Moto-Mixers—Moto-Agitators—Moto-Remixers—Elevators—Conveyors.

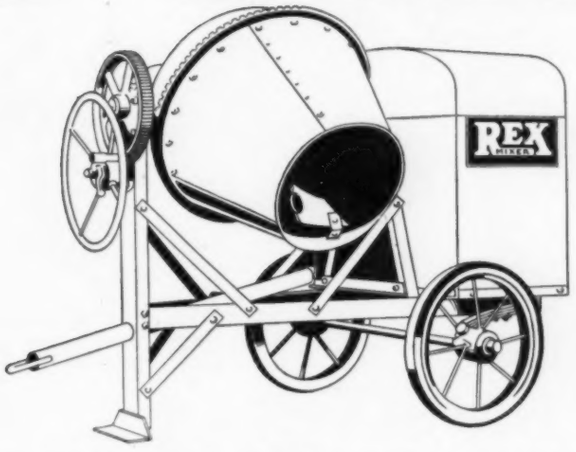
THE many construction machines of the long REX Line bring gold to you. You can actually measure that gold by the features, by the construction, by the speed, by the performance, and by the prices REX gives you.

REX Machines do a given job in fewer minutes, hours or days—REX Machines are built to

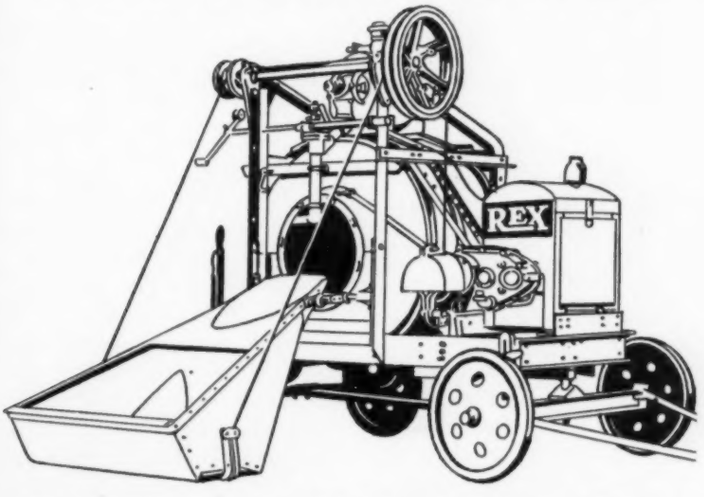
handle more jobs per season—REX Machines can be priced on the basis of economical volume manufacture. We don't ask you to take our word for these things. We let REX Machines prove the points for themselves.

Check them against any others—on any basis you please—that's our challenge. REX

There's Gold



REX TILTER—Try to match it—Full ½-bag capacity—Full 2 h. p. enclosed, self-oiling engine—High tension magneto—Easy dumping hand wheel—Drum lock that locks—The only tilter with automotive springs—Roller bearing wheels—Timken-equipped drum spindle—Easy shoveling height—Dumps cleanly into any barrow—Overpowered, overcapacity—But only $196.80, with steel wheels, cash at Milwaukee.



REX 7-S MIXER—Shimmy skip—All-Steel drum—Steel drum rollers—Timkens—Enclosed, in-oil, cut-gear transmission—7-second skip—7-second discharge—Only 93 inches long—Weighs 500 lbs. less—End controls—Skip knockout—Automotive clutches—But only $805.00 with Le Roi Engine and steel wheels, f.o.b. Milwaukee.

Machines will sell themselves. You can make this check for yourself on pumps, concrete mixers, plaster mixers, mortar mixers and similar equipment in "*That Men May Build Better, Faster, Cheaper.*" It's a book that tells all about the details of Rex Machines. Use coupon.

CHAIN BELT COMPANY,
1664 West Bruce St., Milwaukee, Wis. *Cable Address: Beltchain*

"That Men May Build Better, Faster, Cheaper." This coupon brings a copy of this book which tells the story in cold, hard figures and facts what these Rex Machines are and do:

☐ Diaphragm Pumps ☐ Centrifugal Pumps ☐ Self-Priming Centrifugals
☐ Plunger Pumps ☐ Road Pumps ☐ Tilting Mixers
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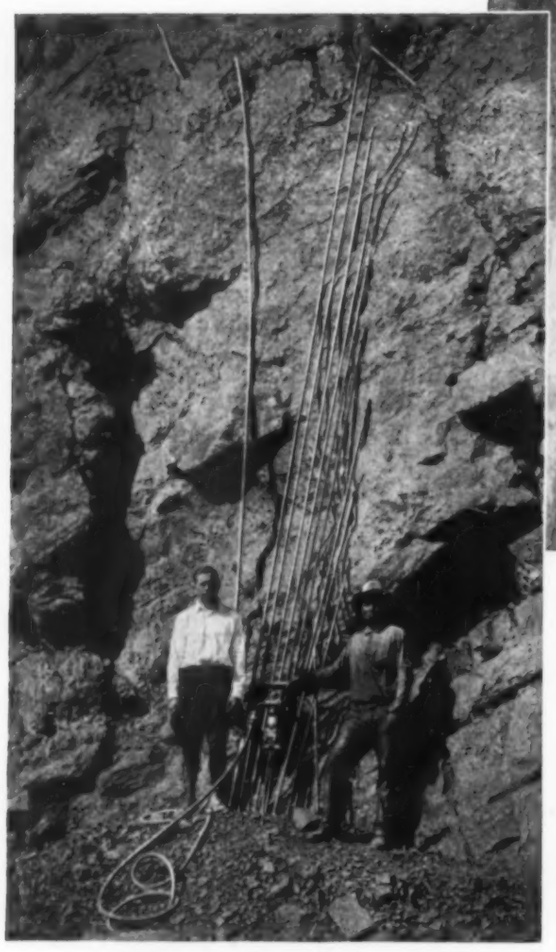
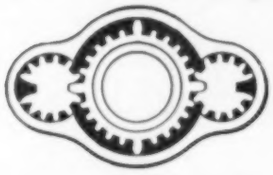
Also Concrete Factories and Moto-Mixers, Paving Mixers



From boulder popping *to* ledge work . . . *From* shaft sinking *to* tunneling



Balanced Independent Rotation
Powerful, Sturdy, Compact

No matter what the rock drilling job, there is a Worthington-Gilman drill that will handle it. With a wide range of sizes and types to select from, it is an easy matter to pick the right unit for any class of work.

The drill intended for one job may be easily changed over to meet different requirements...through the use of interchangeable parts. This means that you can have a wide range of equipment with a minimum investment.

Then too, Worthington-Gilman Rock Drills offer the exclusive "Free-Hammering" feature. The piston has just one job to do...to hammer the drill steel. The steel is rotated by an independent *balanced* motor.

Twenty-four Worthington district offices and a nation-wide dealer organization are now ready to serve rock drill users. *Stocks are maintained at strategic points.* Ask for new literature on the types of equipment in which you are interested.

WORTHINGTON PUMP AND MACHINERY CORPORATION

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PUMPS
All Sizes...All Types
For All Services
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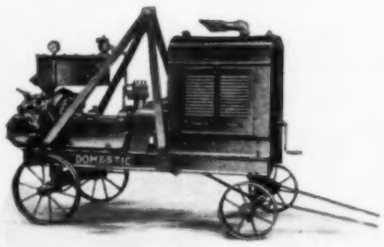
Literature on request

WORTHINGTON

T-8

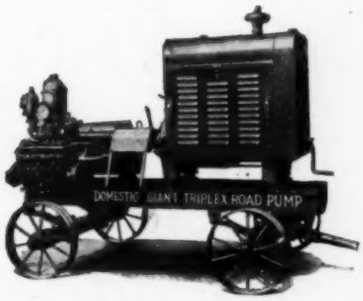
"Domestic" Pumps for Contractors



For the Excavating, Sewer, Pipe Line and Bridge Contractor

"Domestic" Automatic Priming Ball Bearing Centrifugal Pump Units

Capacities—150 to 2000 G.P.M.
Heads—up to 65 feet.
Primes—up to 27 feet Suction.
Sizes 2½ - 3 - 4 - 5 - 6 and 8 inch Suction and Discharge.



For the Road Builder

"Domestic" Giant Triplex

500 lbs. Pressure—Ball Bearing, Force Pump Units.
80 to 100 G.P.M. Capacity.
40 hp., 4-cylinder Engine.

For General De-watering Work

"Domestic" Double No. 4 Diaphragm Pump Units

Manifold Suction for one 4-inch Suction line. Self Oiling Jack with Ball Bearings.
Four Cylinder, Radiator Cooled Engine.

DON'T LET THE WATER HAZARD JEOPARDIZE YOUR PROFIT ON THAT EXCAVATION, SEWER, PIPE LINE, BRIDGE OR ROAD JOB—

Get "Domestic" Pumps and Be Safe

Sizes and types for all conditions encountered by Contractors

—Write us today for descriptive bulletins—

DOMESTIC ENGINE & PUMP CO., Manufacturers, Shippensburg, Penna.

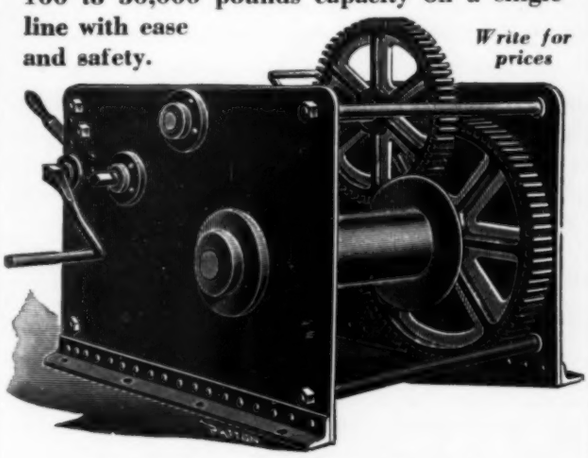
—Distributors in all principal cities throughout the U. S. A.—

TRADE MARK
DOBBIE
ESTABLISHED 1862

WINCHES

A Dobbie Winch for every purpose. From 100 to 50,000 pounds capacity on a single line with ease and safety.

Write for prices



DOBBIE FOUNDRY & MACHINE CO.
Niagara Falls, N. Y.

Stocks carried at Niagara Falls and New York City
WRITE FOR BULLETINS
Derricks, Steel and Wood, Stiff Leg and Guy, Derrick Fittings, Wire Rope Sheaves and Blocks

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Economy

The Toledo is the *only* torch with the new patented Economy Burner. Kerosene consumption cut in half. No wick consumption.

Order from your dealer. Insist on the genuine Toledo.

THE Toledo Torch

TPS The Toledo Pressed Steel Co
TOLEDO OHIO

Save with Steel

Manufacturers of The Toledo Horse—the ideal highway barricade

3-Mile LACKAWANNA PILING Cut-Off Wall used in dyke protecting Hartford Aviation Field

6000 TONS OF LACKAWANNA STEEL SHEET PILING, SECTION AP-16, were driven in constructing the three-mile cut-off wall under the earthen dyke enclosing the low sides of the Brainard Aviation Field, Hartford, Conn. This construction will protect the aviation field from flooding and seepage during high water in the Connecticut River.

In constructing this wall, the contractors, L. E. McLaughlin, Inc., New London, Conn., drove an average of 1000 tons of piling per month, or more than 100 lineal feet of wall per day. The average length of the piling driven was 35 feet.

Lackawanna Section AP-16 is 16 in. wide, has a uniform web-thickness of 3/8-in., a strong, positive interlock, and weighs only 22 lbs. per sq. ft. Its flat design offers sufficient transverse strength for driving in long lengths and for economical bracing, and at the same time results in minimum driving resistance and minimum tendency to damage at the top from heavy steam-hammer blows.

There is a Lackawanna Piling Section — Deep-Arch, Arch-Web or Straight-Web — for every purpose. Bethlehem engineers will gladly cooperate with you and suggest the section most suitable for your job.

BETHLEHEM STEEL COMPANY General Offices: Bethlehem, Pa.

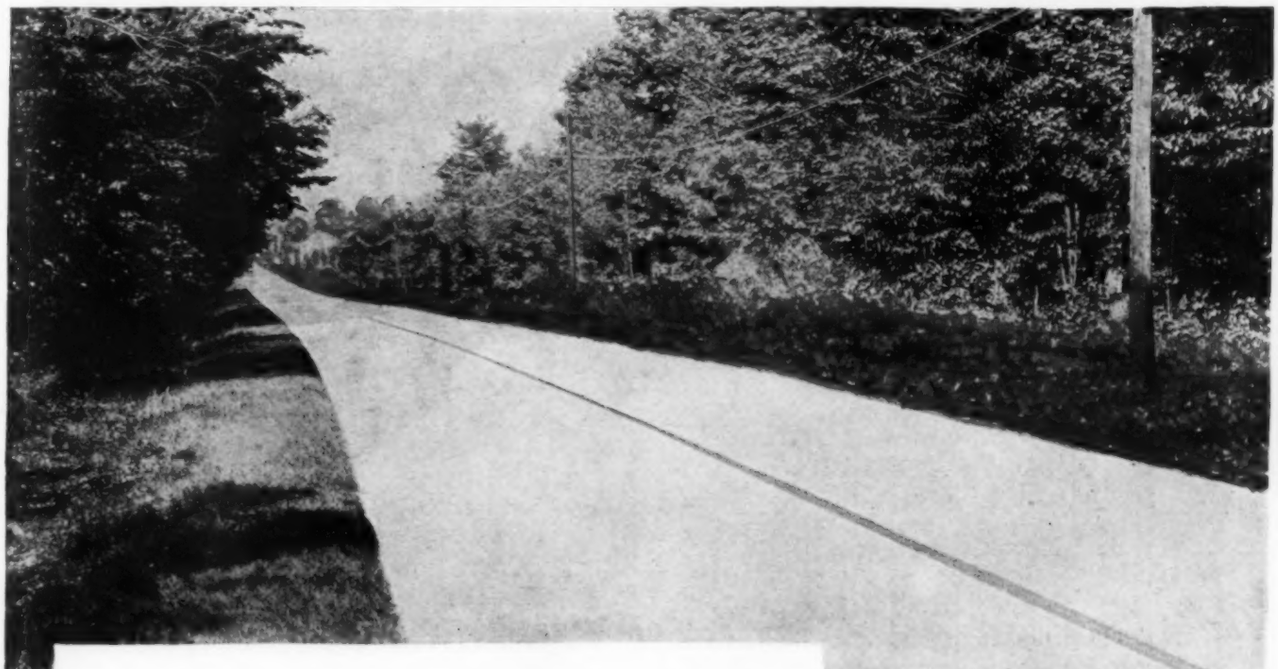
District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Detroit, Cincinnati, Chicago, St. Louis.

Pacific Coast Distributor: Pacific Coast Steel Corporation, San Francisco, Los Angeles, Portland, Seattle, Honolulu.

Export Distributor: Bethlehem Steel Export Corporation, 25 Broadway, New York City.

BETHLEHEM

AUTHORITY SPEAKS!



CAREFUL inspections of concrete pavements cured by the Calcium Chloride surface method were made by a special committee of the Highway Research Board. Extensive mileage cured under various conditions in many states gave opportunity for comprehensive research and appraisal. No meager, inconclusive observations of just a few pavements.

After exhaustive tests the committee reported that Calcium Chloride surface curing (1) does not create volume changes that cause cracking, (2) does not cause scaling, and (3) attains strengths equivalent to the wetted earth method.

Calcium Chloride surface treatment is the only method other than wetted earth which has passed all conditions set forth by the Highway Research Board as necessary for the proper curing of concrete. Send the coupon for complete imformation.

APPROVED by HIGHWAY RESEARCH BOARD — U.S. BUREAU OF PUBLIC ROADS

Calcium Chloride Publicity Committee

FLAKE

CALCIUM CHLORIDE

"develops full strength concrete"

Send the coupon to any one of these companies:

The Columbia Products Company, Barberton, Ohio
The Dow Chemical Company, Midland, Michigan
Solvay Sales Corporation, 61 Broadway, N. Y. City

Please send complete data on Calcium Chloride concrete curing practice.

Name _____

Position _____

Address _____

CM 3-31

THESE ARE Schramm compressors . . . .

2 No. 120 Schramm Compressors operating back-fill tampers . . . Peoples Natural Gas Co., Pittsburgh, Pa.

Pipe lines are being put in for natural gas all over the country, in all of the thriving cities. And that's good—cheaper gas for householder and industry—more work for Schramm Compressors and Schramm Tools.

The day-in and day-out dependability and economy of Schramm Compressors makes them popular with public utilities and contractors everywhere. And easy-starting, trouble-free operation makes them equally popular with the men on the job.

For dependability, efficiency and economy buy a Schramm. Send for the catalog.

Schramm Inc.

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BRANCH OFFICES:

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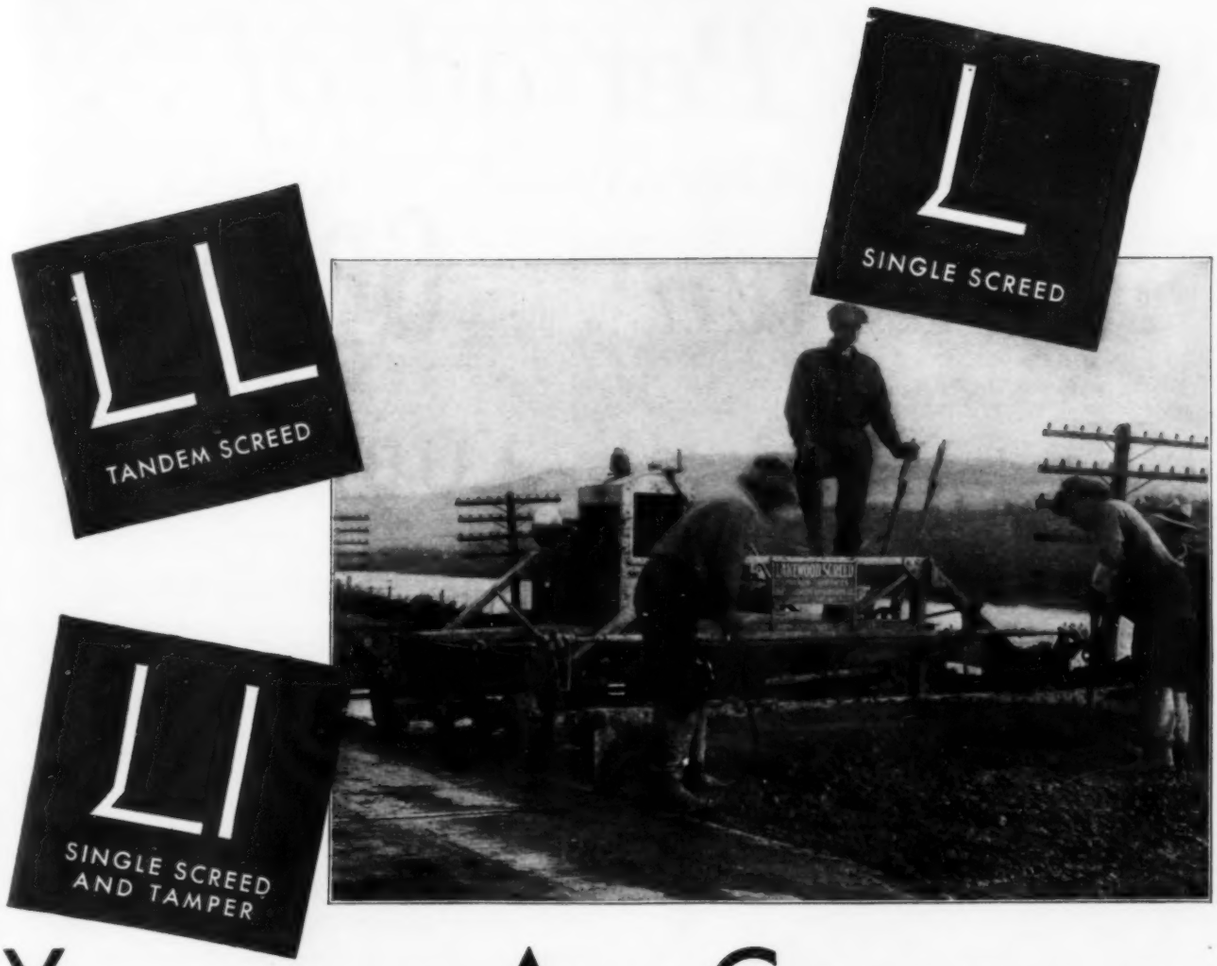

You can have ANY COMBINATION with any LAKEWOOD TYPE "C"

LIL
TANDEM SCREED
AND TAMPER

EVERY Lakewood Type "C," whether new or now operating, offers complete choice of 4 combinations easily convertible from one type to any other, on the job. When it's Lakewood Equipment, the smallest investment equips you for maximum service and maximum returns.

For fast, steady production...on concrete or bituminous pavements, city streets or highways...for flexibility, strength and lowest maintenance, use a Lakewood Type "C"...the only Timken equipped Finisher.

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LAKEWOOD ROAD PUMPS
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THE LAKEWOOD ENGINEERING CO.

COLUMBUS, OHIO, U.S.A.

After a Period of . . .

Shut-down . . GREDAG

REG. U. S. PAT. OFF.

LUBRICANTS

GREDAG is the ideal lubricant for equipment that is being placed in service after a period of shut-down. It removes the danger of scoring from bearings that have been exposed to the weather or that have become stiff from weeks of idleness. It reduces depreciation of gears, chains and cables.

GREDAG *Provides Insured Lubrication*

The very fine particles of *pure*, electric furnace graphite, evenly distributed through the soft grease lubricant, quickly develop a graphite filled bearing surface. This graphitic surface has a lower coefficient of friction than plain metal. Furthermore, it is more readily wet by grease, insuring an adhering film of lubrication that prevents metal to metal contact under the heaviest of bearing pressures.

There is a grade of GREDAG for every class of lubrication service.

For dusty, dirty conditions	***For surfaces exposed to water***
For protected operation	***For operations exposed to weather***
For high temperature service	***For cold weather service***

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Carbon Sales Division

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Unit of Union Carbide and Carbon Corporation

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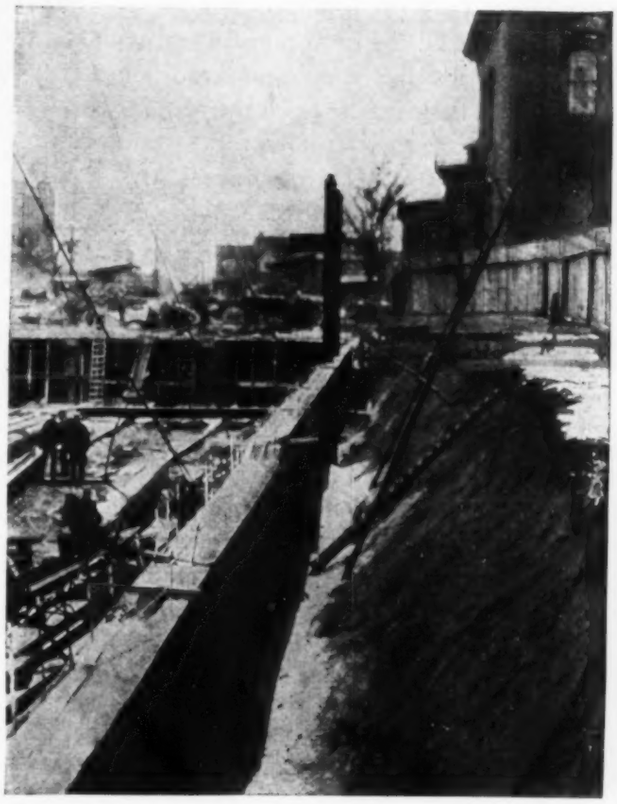
WATERPROOFING, DAMPPROOFING

—Avoid Winter uncertainties by using

HEADLEY EMULSIFIED ASPHALTS

Applied cold without diluting or cutting, set readily, and bond securely to damp or cold surfaces. Not destroyed by freezing.



HEADLEY Emulsified Asphalts are as efficient and just as easy to apply *in Winter* as in Summer, for all types of waterproofing, dampproofing or other protective coating work. No difference exists in tenacity of the bond or uniformity of the finished coating.

The simple method of application as compared to hot asphalts and cut-backs means savings in material, time, and labor, with complete protection.

Headley Emulsified Asphalts give superior service in these applications

Dampproofing and waterproofing of foundations, basements, tunnels, reservoirs, sumps, pits, cisterns, vats, tanks, floors, walls, roofs, etc.

Protection of concrete and masonry against disintegration.

Protective coating of concrete, masonry, structural steel, pipe lines, metal, etc., against the destructive influences of fresh and salt water, moisture, gases, chemical fumes, brine, acids and alkalies, etc.

Bonding and cementing bituminous flooring, linoleum, plaster, stucco, tiles, blocks, slabs, bituminous bridge and crossing planks, fibrous and mineral wall boards, cork board and other insulation, etc.

Write for this BULLETIN and FREE SAMPLE

As largest exclusive manufacturers since 1908 of Emulsified Asphalts for industrial uses, we are prepared to offer authoritative advice, submit trustworthy tentative specifications, and co-operate in connection with ordinary, new or exceptional waterproofing and dampproofing applications. This service is free, and given promptly on request.

HEADLEY EMULSIFIED PRODUCTS COMPANY,
Franklin Trust Building, Philadelphia
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☐ **Please send Bulletin 330 and free sample of Headley Emulsified Asphalt.**

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Name of Company .....

Address .....

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CM

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STEEL GIVES FREEDOM TO DESIGN

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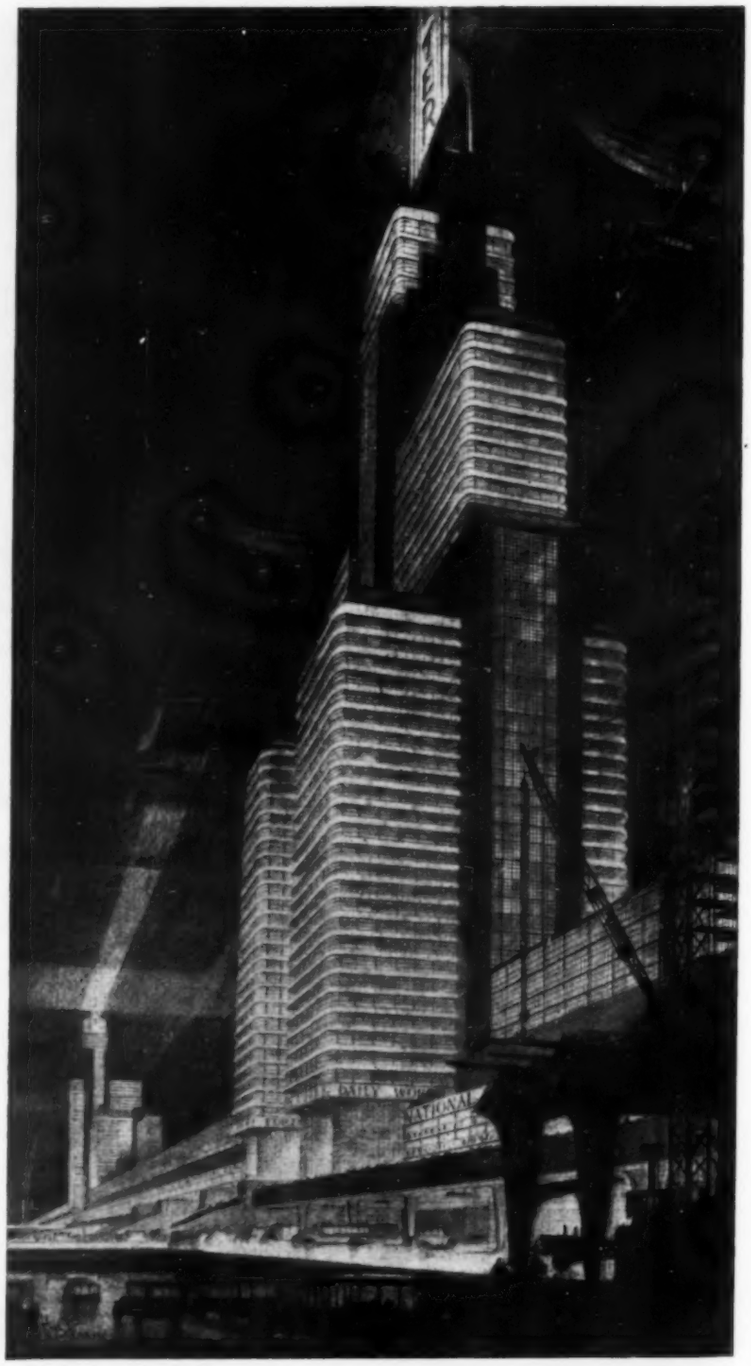
Out of steel's great strength and versatility have come the most amazing structures the world has ever seen. Tradition has had but little influence on them. They are inspiring in their architectural freshness, appropriate to their purposes, efficient to a remarkable degree.

Now, the Age of Steel enters its most interesting phase. . . . The proved principles of skyscraper construction are being applied to dwellings, small apartment and mercantile houses, small factories and schools. They are being built with steel!

Many plants are in large-scale production of the smaller steel shapes. With them you can secure great variety in design, new economy in construction, absolute security and permanence. Use steel for buildings and bridges of every kind—large or small.

Before building anything, find out what steel can do for you. The Institute serves as a clearing house for technical and economic information on steel construction, and offers full and free co-operation in the use of such data to architects, engineers and all others interested.



"STEEL CONSTRUCTION FOR WALLS OF GLASS." AN ENLARGEMENT OF THIS DESIGN BY HUGH FERRISS, ON SPECIAL STOCK FOR FRAMING, WILL BE MAILED WITHOUT CHARGE TO ANY ARCHITECT, ENGINEER OR BUSINESS EXECUTIVE.

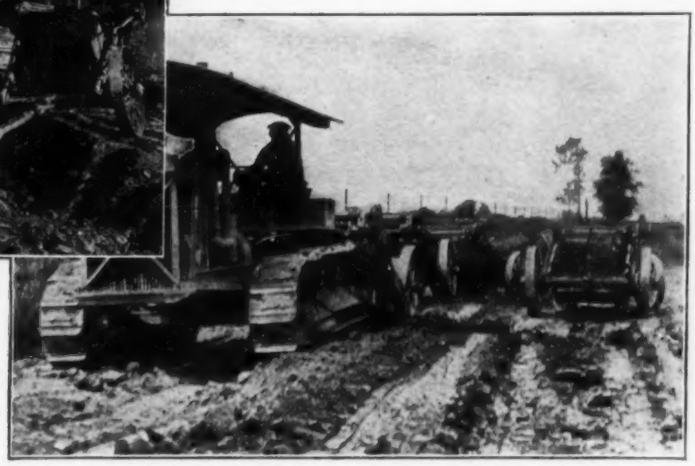
The co-operative non-profit service organization of the structural steel industry of North America. Through its extensive test and research program, the Institute aims to establish the full facts regarding steel in relation to every type of construction. The Institute's many publications, covering every phase of steel construction, are available on request. Please address all inquiries to 200 Madison Avenue, New York City.—In Canada, to 710 Bank of Hamilton Bldg., Toronto, Ontario. District offices in New York, Worcester, Philadelphia, Birmingham, Cleveland, Chicago, Milwaukee, St. Louis, Topeka, Dallas, San Francisco and Toronto.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

STEEL INSURES STRENGTH AND SECURITY

Baker Maney Scrapers trailing back with full loads over rough ground on road job.

A train of 5 Baker Maneys turning completely around on a 20-foot dirt fill.



Smooth Trailing— Short Turning with these Outstanding Scrapers

They turn around on a 20-foot fill—easily. They trail smoothly over the roughest surfaces. These features of Baker Maney Scrapers cut round trip time by shortening distances and convert the time saved into additional yardage. Four-wheeled construction accounts for this. But do not overlook other reasons for Baker Maney supremacy — low center of gravity—accurate cutting—big capacity —quick loading and dumping—Timken bearings— rugged construction—low up-keep and operating costs. No matter what earth moving equipment you may have, there's a place for Baker Maneys in your equipment. Let us show you why they can earn their way for you.

BAKER MANEY
Reg. U.S. Pat. Off.
Self Loading Scrapers

1½ yard
1 yard
¾ yard

Baker Road Rooter tearing up tough soil preparatory to use of grading equipment.

BAKER ROAD ROOTERS

Prolong The Life Of Grading Equipment

By loosening up the ground more thoroughly than any other method, Baker Road Rooters save wear and tear on your grading equipment. They tear up old macadam, gravel, and other tough surfaces. You will be impressed by their great strength—built for the heaviest jobs. There's easy automatic control of points from the drivers seat. Learn how you can use them to save your equipment—increase yardage—save money.

USE THIS COUPON IN REQUESTING LITERATURE

The Baker Mfg. Co.
568 Stanford Ave.,
Springfield, Ill.

Please send literature on the following:

Baker Maney Scrapers ☐ Baker Road Rooters ☐
Buildozers ☐ Backfillers ☐ Rotary Scrapers ☐

Name .....

Address .....

68

Tramway carrying 220 tons hourly of sand and gravel for the construction of the Pardee Dam in California. Built for the contractors—Atkinson Construction Co.

Locked Coil Track Cable used on American Steel & Wire Company Tramways.

AMERICAN
TRENTON-BLEICHERT SYSTEM
Aerial TRAMWAYS

This system provides an economical and dependable method of transporting material in every kind of country—over mountains, valleys, and rivers; to and from locations entirely inaccessible by surface routes.

We supply everything from the preliminary plan to the completed tramway. Let our engineers help you with your transportation problems. **Also economical over level country.**

1831 — COMMEMORATING 100 YEARS OF PROGRESS IN WIRE MAKING — 1931

AMERICAN STEEL & WIRE COMPANY

208 So. La Salle St., Chicago — SUBSIDIARY OF UNITED STATES STEEL CORPORATION — And All Principal Cities

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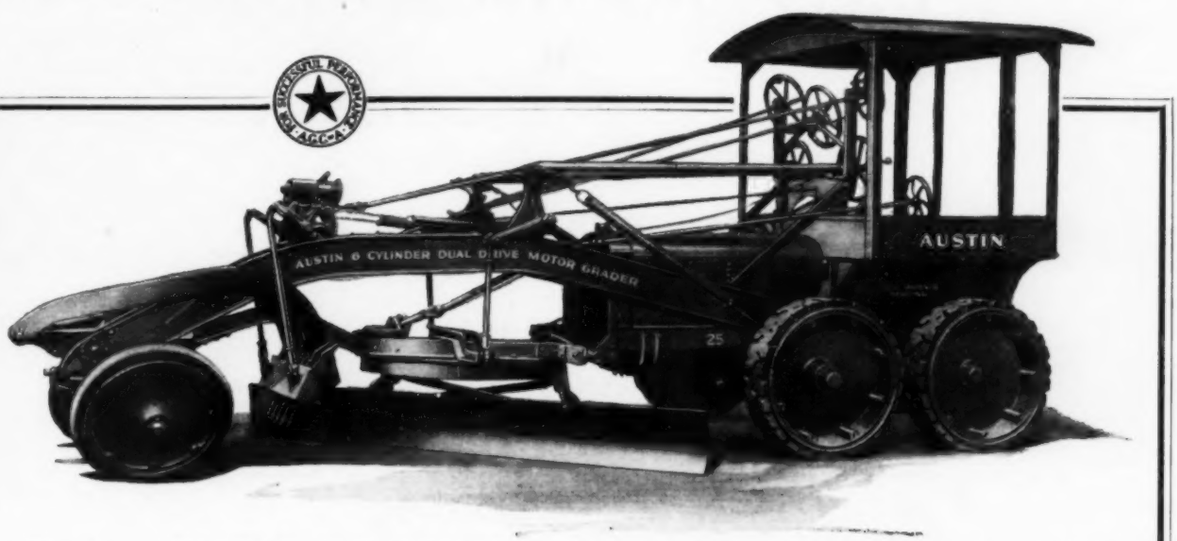
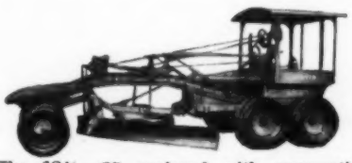
LARGEST MANUFACTURERS OF WIRE ROPE IN THE WORLD

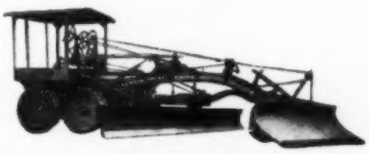
You will find the machine you need in the *complete* Austin-Western Motor Grader Line . . . .



The famous 12½—25 Austin Dual Drive Motor Grader equipped with 12" solid rubber tires. Unlike most motor graders, this machine has a 6-cylinder motor instead of being built around a standard tractor. It has far more power than an ordinary maintenance machine. 12" tires on all four drive wheels give enough ground contact to utilize the full power of the motor.



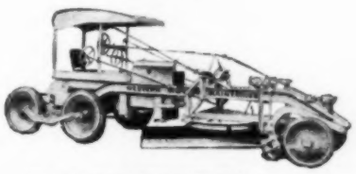
The 12½—25 equipped with pneumatic tires including dual pneumatics on the four drive wheels.



Model "20" Austin Dual Drive Motor Grader with Special Snow Plow Equipment.

Model "20" Austin Dual Drive Motor Grader equipped with crawler tread.

The Austin Model "20" Single Drive Motor Grader.



The Western Motor Maintainer with blade and scarifier attachment.

The Western Motor Maintainer with solid steel drag attachment.

The A-W Motor Grader line is most complete in every respect. It is made up of a wide variety of units, each with characteristics to suit individual preferences or to meet special conditions.

It includes graders powered by a number of widely known power plants as well as completely factory-built models with operating features not possible when standard tractors are used.

Write for complete information—now.

The Austin-Western Road Machinery Co.

400 N. Michigan Ave., Chicago, Ill. Branches in principal cities.

Leaning Wheel Graders, Straight Wheel Graders, Motor Graders, Elevating Graders, Crawler Dump Wagons, Scarifiers, Rock Crushers, Portable Conveyors, Rollers, Motor Sweepers, Street Sweepers, Sprinklers, Road Oilers, Hot Patch Portable Asphalt Plants, Plows and Scrapers.

Austin-Western
ROAD MACHINERY

Padlocked Minds

have no use for a Business Paper...

IT'S not so much *what* you read that counts, as what you read it *for.*

Reading to pass the time away is *one* thing—reading to get *ideas* for improving your business is another.

Men completely satisfied with what they have—insensible to progress—oblivious to change—these read (*when* they read) for entertainment only.

But men whose minds are open to better methods, men whose minds are eager for news of new plans and new practices—these are the men who read the pages of their business papers.

In any industry . . . trade . . . profession, these are the men who count. And just as they are attracted to a publication by the practical, helpful character of its editorial content, so, in the same open-minded mood, they read its advertising pages.

ABP

THIS SYMBOL *identifies an ABP paper . . . It stands for honest, known, paid circulation; straightforward business methods, and editorial standards that insure reader interest . . . These are the factors that make a valuable advertising medium.*

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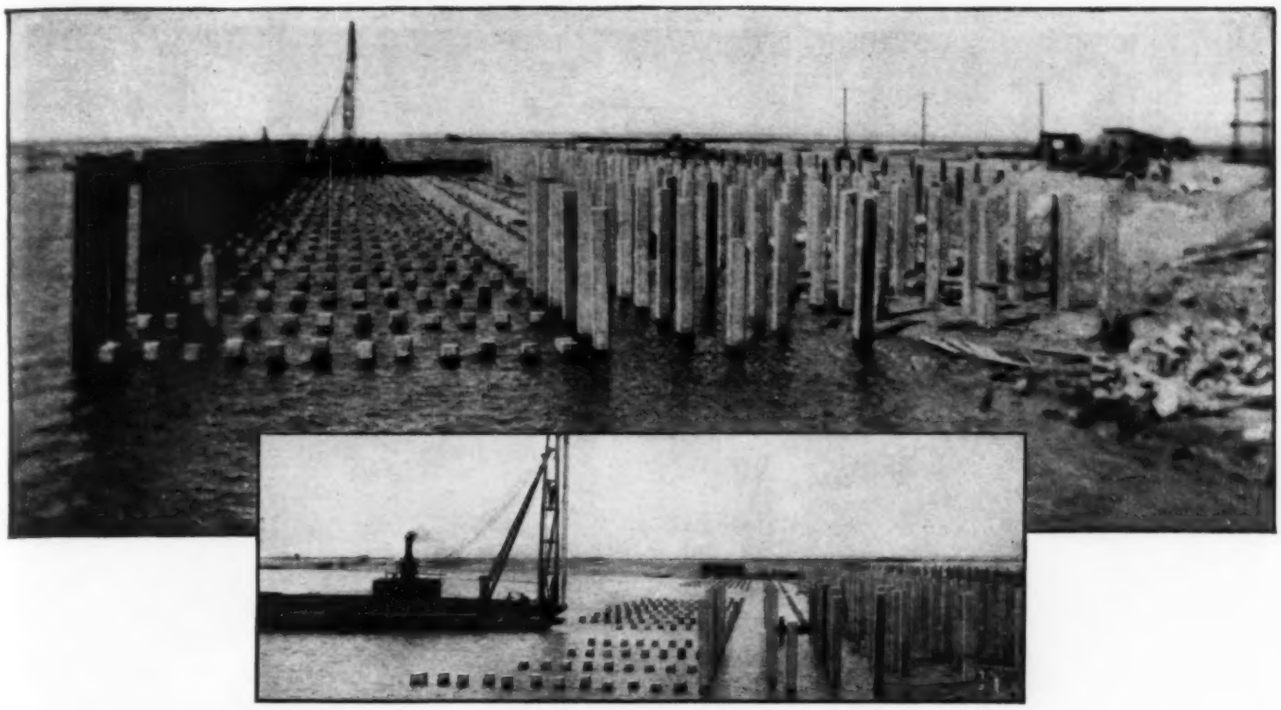


"We didn't break a pile in the whole job"

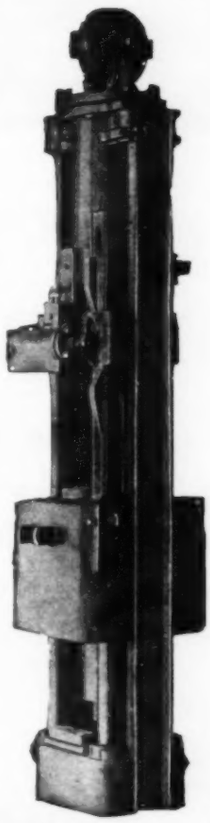
The piles for the new Corpus Christi, Texas, wharf, shown above, were driven by E. A. Whitney & Son. The photos indicate the fine condition of piles and pile heads.

This concern was also the contractor for the pile driving for the Texas & Pacific Ry. at Big Springs, Texas. Regarding this job, the contractor wrote: "We didn't break a pile in the whole job."

On all of this work, Warrington-Vulcan Pile Hammers, "the hammers with the *punch*," were used.

Real *punching* action gets the pile down faster and does it without damage to the pile or to the hammer. The driving energy is all applied to sinking the pile into the soil and is not wasted in shattering or destroying the pile head.

This is due to the fact that in Warrington-Vulcan Hammers the driving action is applied in accordance with scientific engineering principles, by means of which true "punching" action is obtained.



These hammers have been used throughout the country for years and the large important construction jobs on which they have been used are probably a majority of all such work in the United States.

The Vulcan Pile *Extractor* is also made by this company. This efficient, economical machine is the only one built exclusively for pulling piles.

Write for descriptive Bulletins.

VULCAN IRON WORKS

327 No. Irving Avenue, Chicago, Illinois

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Woodward, Wight & Co., Ltd., 451 Howard Avenue, New Orleans, La.
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Harron, Rickard, & McCone Co., 1609 Bryant St., San Francisco, Calif.
Representative for the States of Washington and Oregon:
A. H. Cox & Co., Inc., 1757 First Avenue, S., Seattle, Wash.

WARRINGTON-VULCAN

The Warrington-Vulcan Hammer is built in a number of sizes of which the weights of the ram or striking parts is as follows: No. 0, 7500 lbs.; No. 1, 5000 lbs.; No. 2, 3000 lbs.; No. 3, 1800 lbs.; No. 4, 550 lbs.

LOWER COSTS AND BETTER RESULTS

Haulage is not an unknown cost factor with Reo Speed Wagons and Trucks on the job. These sturdy vehicles have long served contractors on the biggest building projects with exceptional economy.

The Reo is *engineered* for tough jobs. Scientifically strong frames, long-life motors, husky transmissions and a Reo-built 2-speed axle (optional) with tremendously powerful low gear ratio of 78.1 to 1.

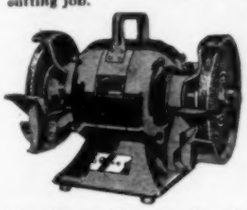
REO MOTOR CAR COMPANY, LANSING, MICHIGAN

SPEED WAGONS REO AND TRUCKS

Save Time with
VAN DORN
Electric Tools

Van Dorn Electric Tool Kit No. 5

Especially designed for electricians, plumbers and carpenters to carry tools to the work—will do almost any drilling or hole cutting job.



Van Dorn Electric Bench Grinders

Ideal for tool sharpening. Available in 6", 7" and 10" wheel sizes; complete with coarse and fine grinding wheels.

Van Dorn Portable Electric Saws

Six times as fast as hand sawing. Thoroughly safe to operate.

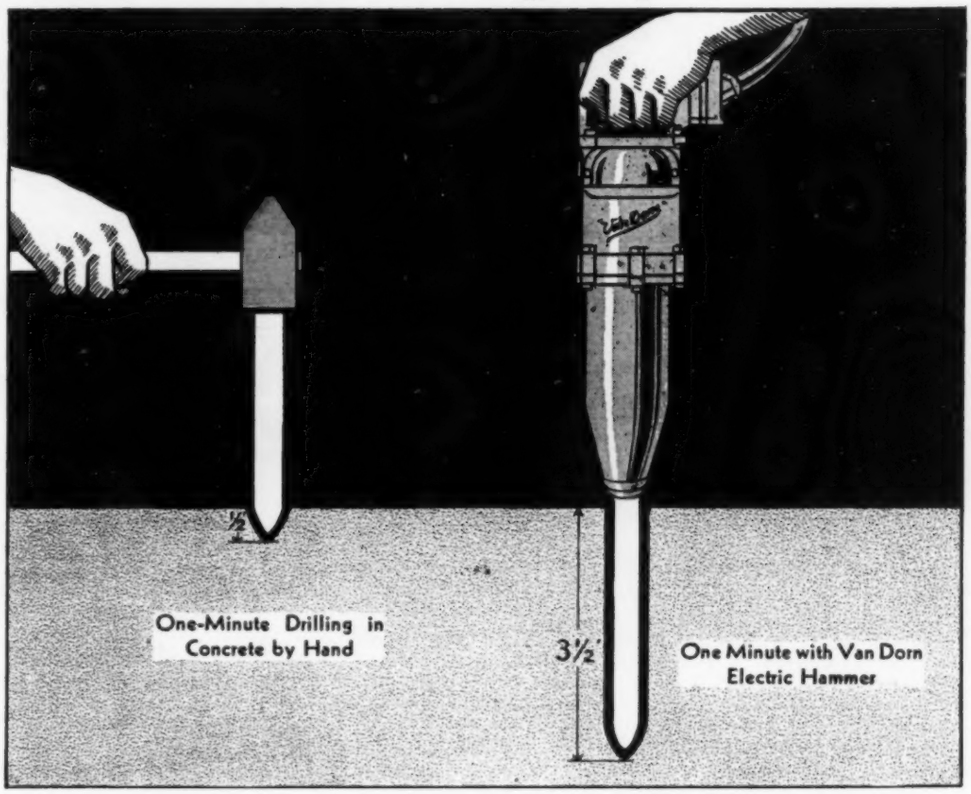
Van Dorn Portable Electric Screwdrivers

Ideal for driving wood screws up to No. 16; lag screws to 5/16"; nuts and bolts to 3/8". Two convenient sizes. No. 1 shown.

Van Dorn Portable Electric Drills

Proper size and ample power for any job, from 1/4" light duty to 1 1/2" heavy duty. 3/4" size shown—ideal for building construction.

Still Hammering By Hand?



A Van Dorn Electric Hammer Does the Job Seven Times as Fast!

DON'T waste time and labor driving drills by hand! Van Dorn Electric Hammers turn all kinds of drilling, chiseling, and demolition intc quick, easy work! They deliver hard, fast blows—2300 to 3300 a minute.

For installing elevators and theatre seats, wrecking brick buildings, drilling concrete or brick for pipe and conduit, and all such construction jobs, these efficient electric hammers are vitally essential. Speed up your work with this economical, powerful tool!

Fitted with Universal Motor—works off any electric light socket. Available in 5/8", 1 1/8" and 1 1/2" capacity sizes. See them at your distributor's today!

For Power Specify

"Van Dorn"

The VAN DORN ELECTRIC TOOL CO.
TOWSON, MARYLAND

MAIL THIS COUPON FOR CATALOG

The VAN DORN ELECTRIC TOOL CO.
TOWSON, MARYLAND, U. S. A. CON

Please send me catalog showing full line of Electric Tools. I am particularly interested in:

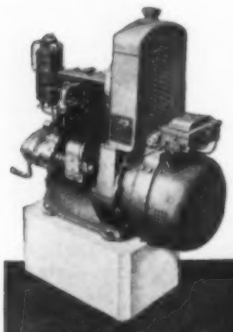
- ☐ Electric Hammers
- ☐ Electric Saws
- ☐ Electric Grinders
- ☐ Electric Drills
- ☐ Electric Screwdrivers
- ☐ Electric Tool Kits

Name .....

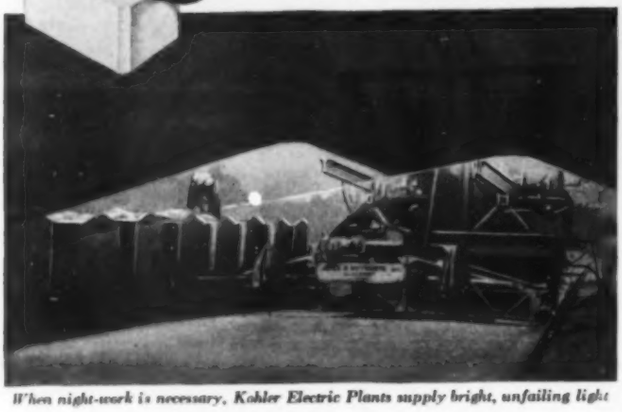
Address .....

Jobber's Name .....

Beat bad weather, keep to schedule with KOHLER ELECTRIC PLANTS



Model E Kohler Electric Plant—used on pavers and other portable equipment to supply electric current



When night-work is necessary, Kohler Electric Plants supply bright, unfailing light

KOHLER Electric Plants make it possible to keep the job going 24 hours a day. When there's been a long spell of rain — when unexpected fills threaten an upset of original plans — when there's any other surprise handicap that is likely to block the schedule — rely on Kohler Plants to turn night into day.

Kohler Plants — compact, rugged units which supply steady, unfailing electric current — are the ideal source of light for pavers and other portable machinery used in construction work. Even where there are no delays, they enable the contractor to get ahead of schedule in order to insure a bonus for early completion, or to get started on another job.

Large storage batteries are not necessary with Kohler Plants. Current comes direct from the generator — gasoline or natural gas serves as fuel. Current is generated at 110 or 220 volts A.C. or D.C. Capacities range from 800 watts to 10 K.W.

The attached coupon will bring you information specialized to your needs. Kohler Co. *Founded* 1873. Kohler, Wis.—*Shipping Point*, Sheboygan, Wis. —Branches in principal cities. . . . Manufacturers of Kohler Plumbing Fixtures.

KOHLER OF KOHLER ELECTRIC PLANTS

KOHLER CO., Kohler, Wisconsin

Gentlemen: Please send catalog describing Kohler Electric Plants.

*Name*_____

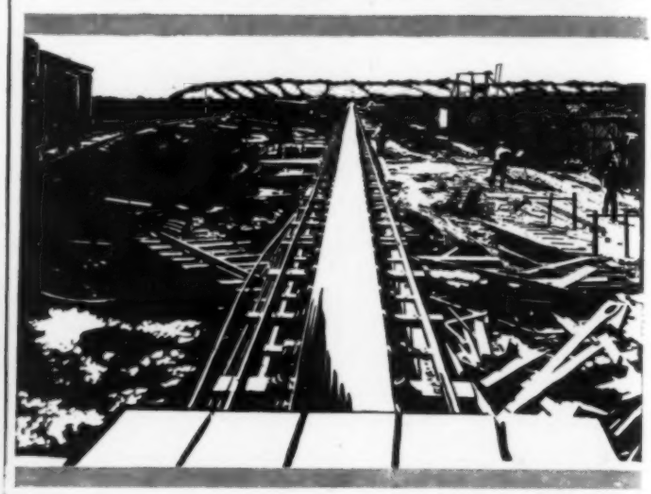
CM-3-31

*Street*_____

*City*_____ *State*_____

*Use in which interested*_____

DIXON'S



UNAFFECTED BY HEAT, COLD OR MOISTURE

Makes any bearing run smoother, with less attention and with actual economy in lubricant and attention.

DIXON'S Graphite Cup Grease is used on bearings having grease cup, or pressure lubrication — regardless of the service, or bearing pressure.

Graphite puts a shiny, smooth finish on any bearing, prevents metal to metal contact and insures long wear with minimum maintenance.

Try it on any balky bearing. A sample will convince you quickly.

Other DIXON Products

Pipe Joint Compound
Waterproof Graphite Grease
Solid Belt Dressing
Flake Graphite
Silica-Graphite Industrial Paint

Joseph Dixon Crucible Co.

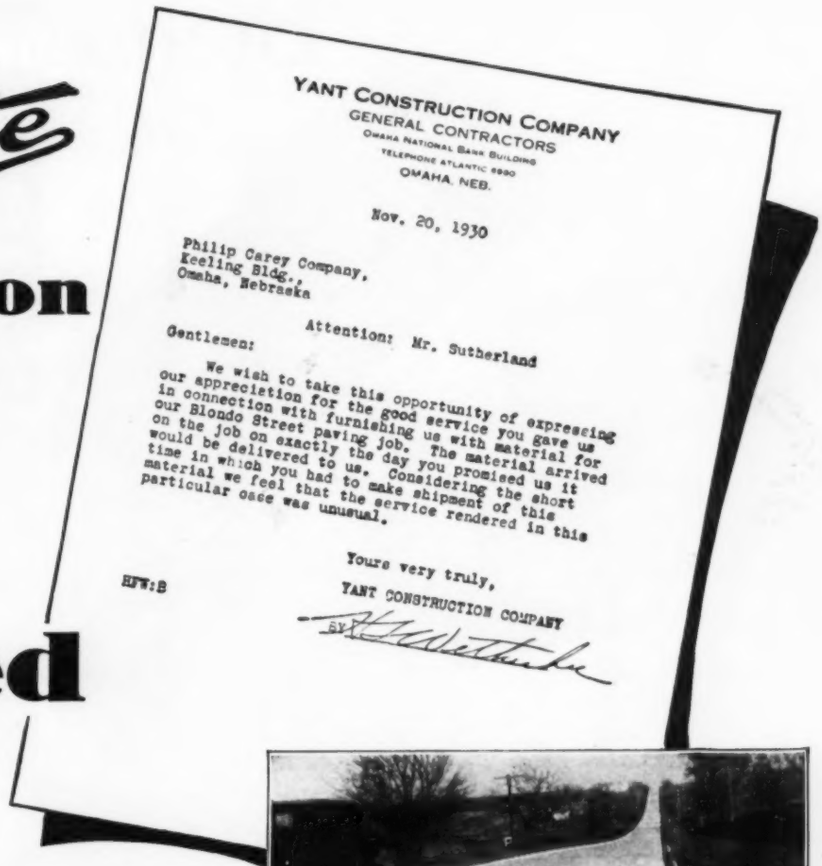
Jersey City GRAPHITE EXCELLENCE SINCE 1827 **New Jersey**

104 YEARS OF DIXON SERVICE

DIXON'S GRAPHITE CUP GREASE

Carey Elastite

Expansion Joint



YANT CONSTRUCTION COMPANY
GENERAL CONTRACTORS
Omaha National Bank Building
Telephone Atlantic 6990
OMAHA, NEB.

Nov. 20, 1930

Philip Carey Company,
Keeling Bldg.,
Omaha, Nebraska

Attention: Mr. Sutherland

Gentlemen:

We wish to take this opportunity of expressing our appreciation for the good service you gave us in connection with furnishing us with material for our Blondo Street paving job. The material arrived on the job on exactly the day you promised us it would be delivered to us. Considering the short time in which you had to make shipment of this material we feel that the service rendered in this particular case was unusual.

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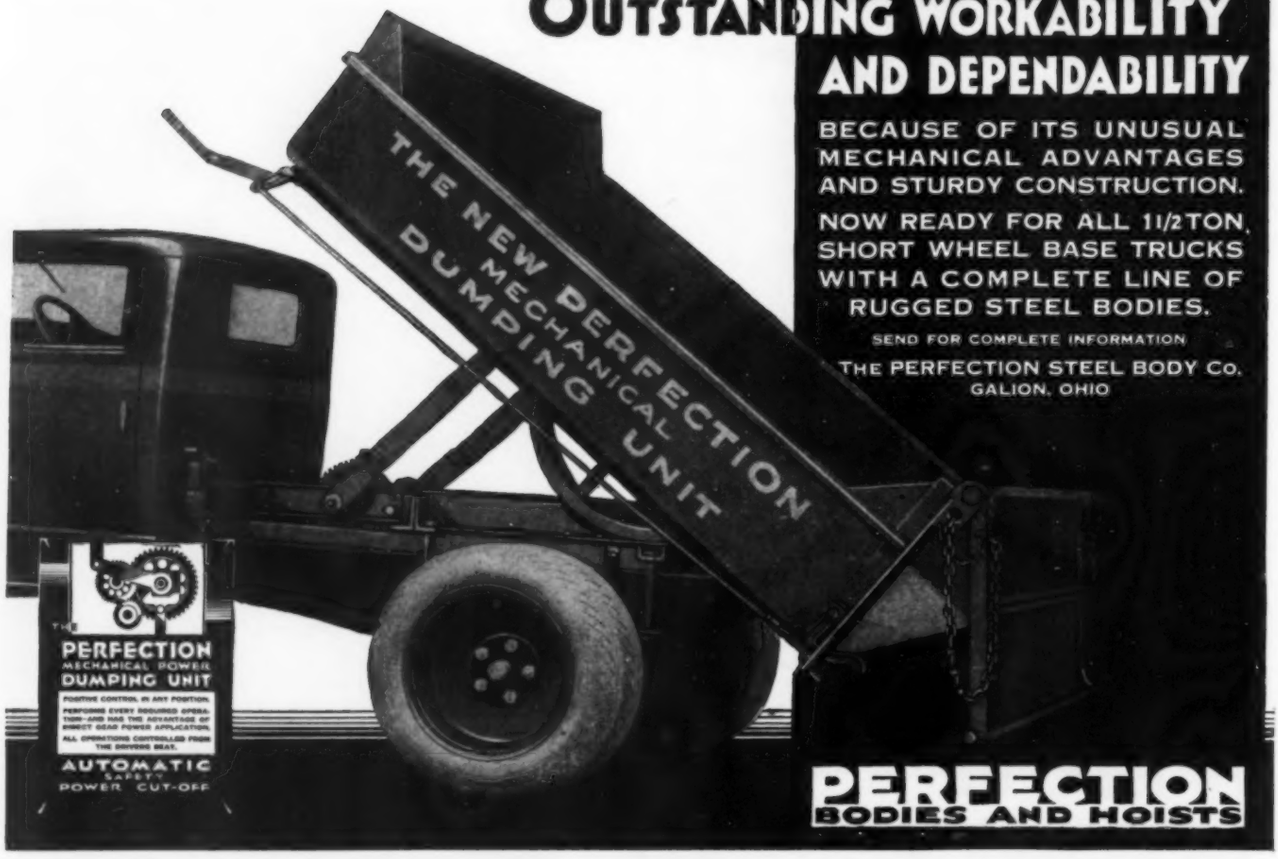
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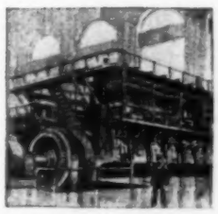

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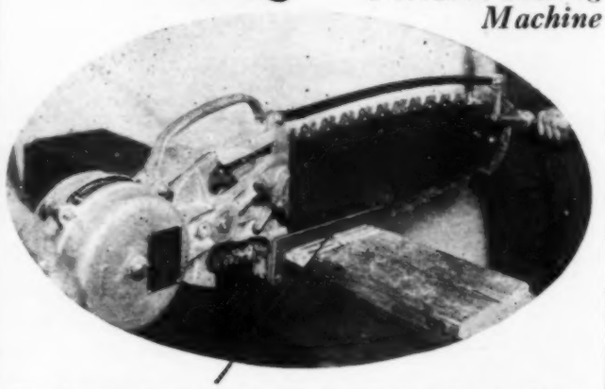

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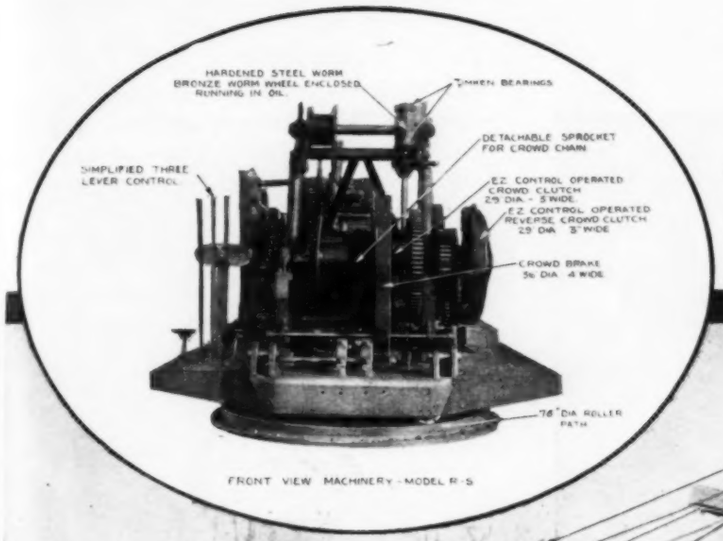

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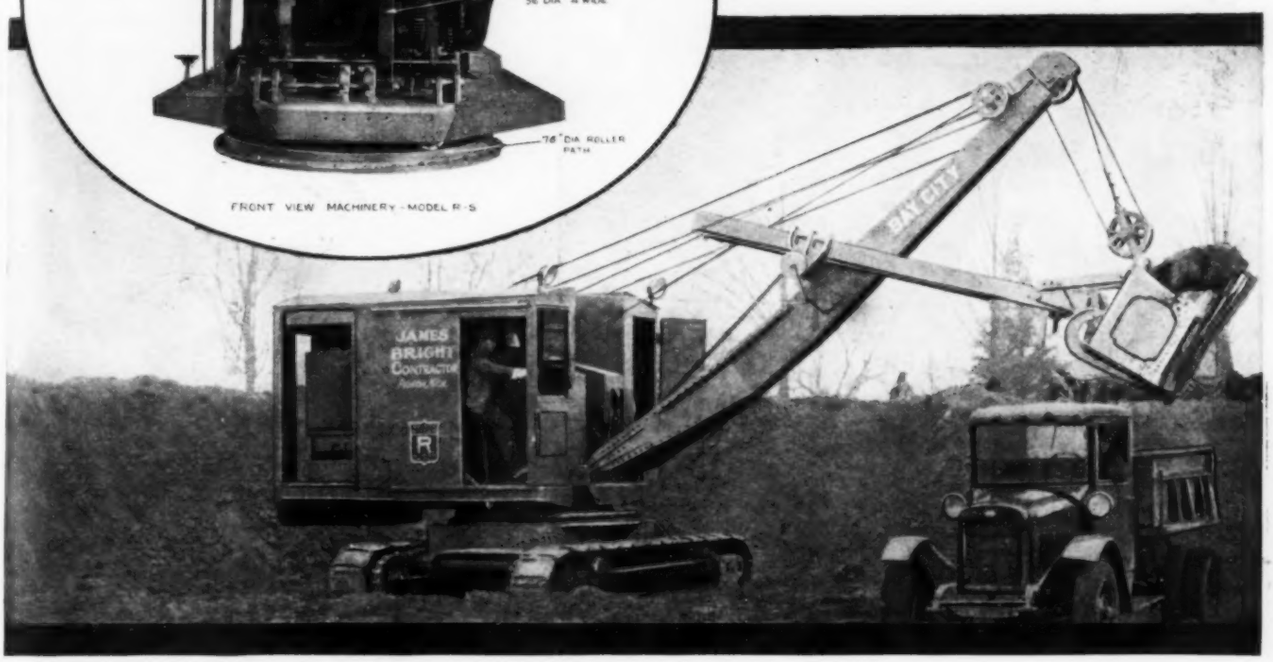

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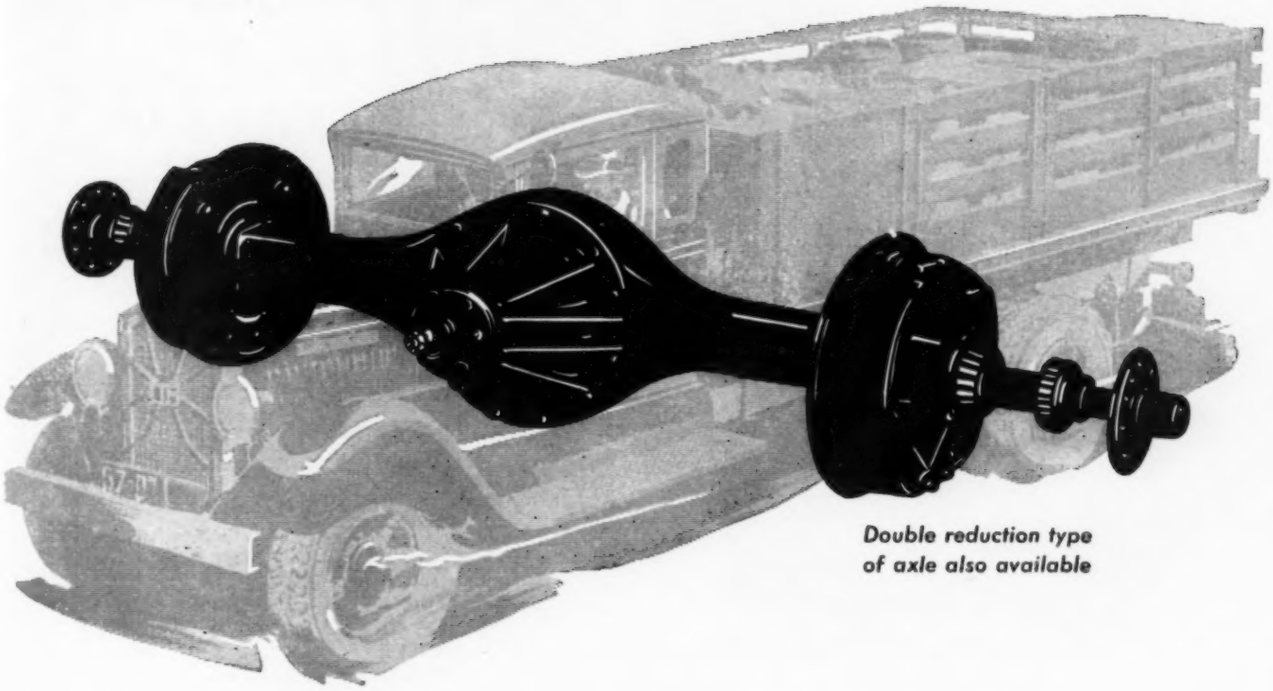

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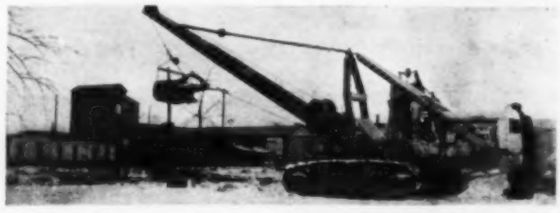

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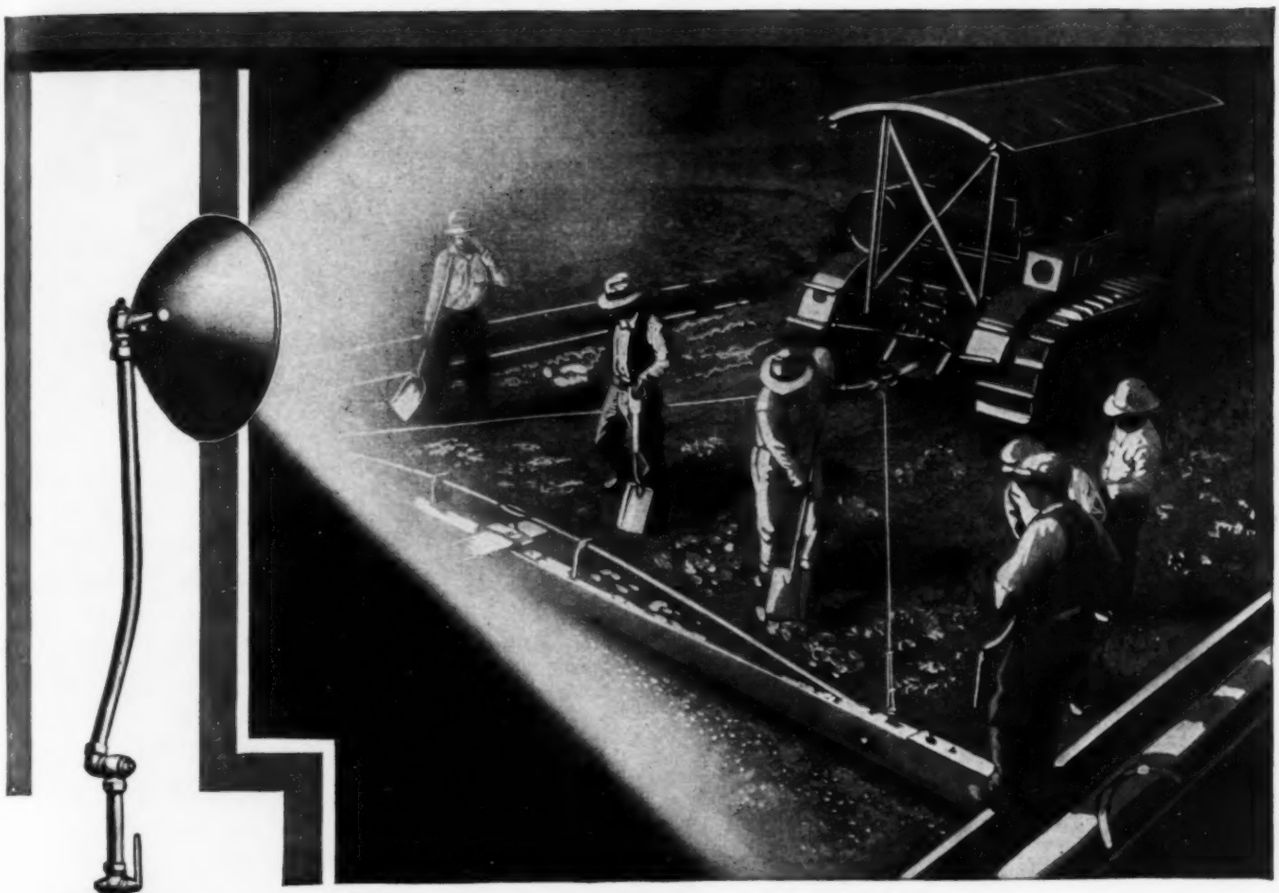

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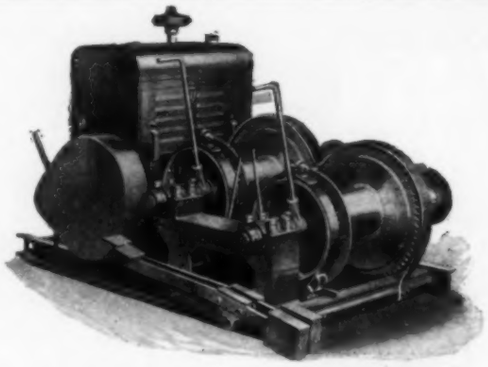

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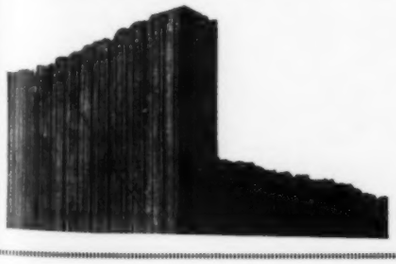

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ALPHABETICAL INDEX TO ADVERTISERS

This index is published as a convenience to the reader. Every care is taken to make it accurate, but *Construction Methods* assumes no responsibility for errors or omissions.

	Page
American Hoist & Derrick Co.	22
American Institute of Steel Constr.	96
American Steel & Wire Co.	98
Associated Business Papers, Inc.	100
Austin Mchry. Corp.	75
Austin Western Road Machry. Co.	99
Autocar Company	4
Baker Mfg. Co.	97
Barber-Greene Co.	68-69
Bay City Shovels, Inc.	109
Bethlehem Steel Co.	90
Biggs Boiler Works Co.	79
Blaw-Knox Co.	24-25-26
Buckeye Traction Ditcher Co.	3rd Cover
Bucyrus-Erie Co.	9
Byers Machine Co.	81
Calcium Chloride Publicity Committee	91
Carey Company, Philip	105
Carnegie Steel Co.	2nd Cover
Caterpillar Tractor Co.	78
Chain Belt Company	86-87
Cleveland Pneumatic Tool Co.	82
Cleveland Rock Drill Co.	12
Cleveland Tractor Co.	76-77
Clyde Iron Works Sales Co.	6
Columbia Products Co.	91
Commercial Credit Co.	107
Consolidated Iron & Steel Co.	27
Crucible Steel Co. of America	3
Dake Engine Co.	114
Davey Compressor Co., Inc.	23
Dixon Crucible Co., Joseph	104
Dobbie Fdry. & Mach. Co.	89
Dodge Bros. Corp.	111
Domestic Eng. & Pump Co.	89
Dow Chemical Co.	91
DuPont de Nemours & Co., E. I.	80
Fate-Root-Heath Co.	7
Foote Company	71
Fulton Bag & Cotton Mills	108
Fundom Hoist & Shovel Co.	112
Galion Iron Works & Mfg. Co.	85
Hauck Mfg. Company	18
Headley Emulsified Prod. Co.	95
Heltzel Steel Form & Iron Co.	10
Hercules Motor Corp.	115
Hitchcock Co., Inc.	110
Jaeger Machine Co.	84
Kohler Company	104
Lakewood Engrg. Co.	93
Le Roi Company	19
Leschen & Sons Co., A.	13
Linde Air Products Co. (Unit of Union Carbide & Carbon Co.)	113
Lincoln Electric Co.	8
Link Belt Company	14-15
Linn Mfg. Company	17
Lowell Wrench Company	110
McGraw-Hill Book Co.	108-114
Metropolitan Paving Brick Co.	50-51
Moritz-Bennett Corp.	106
National Carbon Co.	94
National Equipment Co.	20-21
Northwest Engineering Co.	5
Novo Engine Co.	72
Owen Bucket Co.	11
Perfection Steel Body Co.	106
Plymouth Locomotive Works	7
Ransome Concrete Mchry. Co.	83
Reed-Prentice Corp.	108
Reo Motor Car Co.	102
Riddell Co., W. A.	110
Roebling's Sons Co., John A.	Insert, 73-74
Rogers Brothers Corp.	118
Sabin Company	118
Schramm, Inc.	92
Searchlight Section	117
Solvay Sales Corp.	91
Sterling Wheelbarrow Co.	116
Street Bros. Machine Works	106
Sullivan Machinery Co.	112
Texas Company	4th Cover
Thew Shovel Co.	28-29
Toledo Pressed Steel Co.	89
Toledo Wheelbarrow Co.	112
Universal Atlas Cement Co.	30
Universal Crane Co.	67
Van Dorn Electric Tool Co.	103
Vulcan Iron Works	101
Watson-Stillman Co.	114
Wehr Company	70
Williams Co., G. H.	16
Worthington Pump & Mchry. Corp.	88

▼ ▼ ▼

SEARCHLIGHT SECTION

Classified Advertising

Classifications	Page
BUSINESS OPPORTUNITIES	116
EMPLOYMENT	116
USED AND SURPLUS EQUIPMENT	
Foster Co., L. B.	117
Hyman-Michaels Co.	117
Lindheimer, Inc., S. W.	117
Overlook Machinery Sales	116
Wemlinger, Inc.	117

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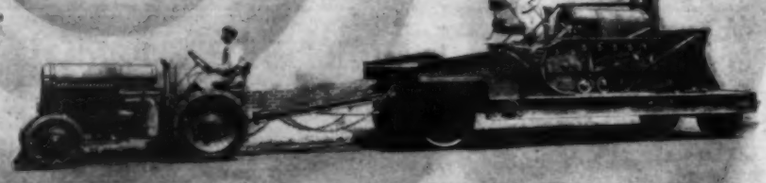

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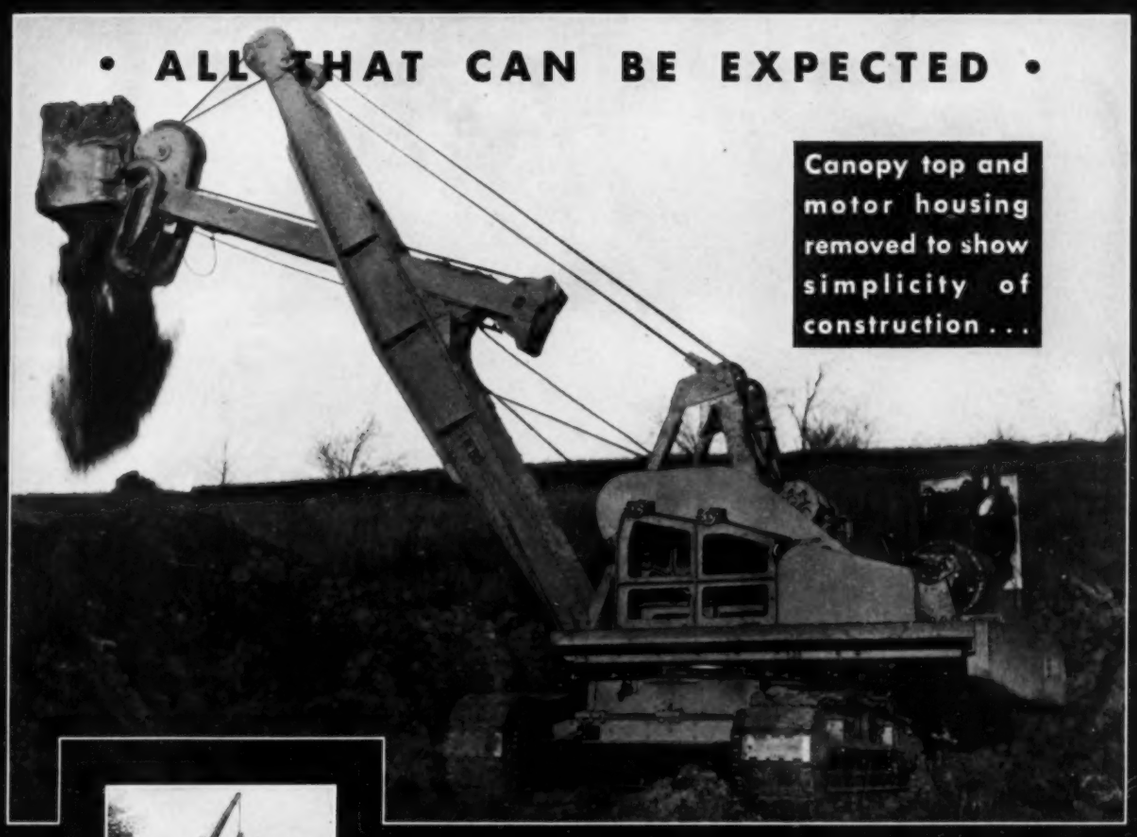

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